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FUNDAMENTALS OF BONE CONDUCTION *

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Sound vibrations conducted to the ear by way of the cranial bones are distributed to and through all parts of the head and reach the inner ear mainly in two ways:

1. By immediate transmission through the solid structures. (Thus the petrous bone is set in motion. The stapes relatively remaining still, the endolymph vibrations act on the oval and round windows in opposite phases, that is, one goes in while the other goes out, the same as in air conduction).

2. By mediate conduction through the solid structures to the external meatus and middle ear air spaces, and thence by secondary excitation of the tympanum and ossicles to the labyrinth.

The difference between the paths traversed by bone conduction and by air conduction depends somewhat on frequency, and is one purely of degree, as by air conduction sound reaches the ear not only through the air in the meatus, but also by way of the cranial bones. However, it is this difference in degree which suggests the use of these two methods for differential functional diagnosis.

Elementary reasoning suggests that obstructive lesions anywhere along the air conduction paths will diminish (varying with frequency) the perception for air borne sounds, while bone conducted sounds will not markedly change.

If, then, we encounter an obstructive lesion, the auditory nerve acuity should be tested by bone conduction, thus shunting around or through the obstruction. If bone conduction is diminished, one reasons that the auditory nerve or end-organs must be below par. Unfortunately, the matter is not so simple, although present teaching and methods of diagnosis would lead one to infer that most of us treat the matter in this manner.

Acoustic and electrodynamic studies of other complicated vibratory structures make it appear probable that for a complete dynamic analysis of ear sensitivity, one kind of ear curve, such as that from air conduction, will not be sufficient, and so we should attempt to supply a supplementary chart by bone conduction. This has been impossible in the

* Through the interest and collaboration of Mr. R. L. Wegel, the physics and mathematics of this paper have been carefully checked up.

past because no efficient procedure has been obtainable for measuring and charting bone conduction, and none has even been suggested for measuring and charting both air and bone conduction in the same units of measure.

As generally conceived, an obstructive lesion is one in the external or middle ear, a nerve lesion one in the nerve paths or inner ear. It appears more rational to designate an obstructive lesion as any lesion preventing sound stimulation from reaching the hair cells in the normal manner or amount; and a nerve lesion (pure) as one which diminishes perception of a normal stimulus which has reached the hair cells. With this conception, then, we may designate obstructive lesions as purely mechanical, nerve lesions as purely neuropathic.

Mechanical obstruction to the transmission of sound vibrations may occur from closing the air passages, edema, new growths, fixation or altered tension in the middle ear structures; gummas and tubercles in the outer or inner ear (labyrinth), atresia or variations from normal of the helicotrema or any of the auditory perilymph or endolymph channels or abnormal fluids therein.

Neuropathic variations in perception may occur from stimulation or depression, regeneration or degeneration of the eighth nerve, centers, ganglions or hair cells. Hyperacuity by bone or air conduction is small (if it exists at all) compared to hypo-acuity.

Increased bone conduction in most cases is undoubtedly due to the fact that the deaf do not hear the external masking sounds which perceptibly diminish the hearing by bone and air conduction in normal ears.

Averaging twenty observations on twenty-five ears showed the effect from a Bárány noise apparatus in the oppsite ear to be, in general, a loss by bone conduction in inverse proportion to the degree of deafness. It varies from three to twenty-two seconds (from 5 to 35 sensation units) in the normal ear, to no effect in the markedly deaf. Practice lessens this masking effect, so that in many normal ears little diminution from the noise apparatus is apparent.

Diminished bone conduction in many cases is due to the masking effect of entotic and extotic noises, but in the notably deaf a loss in bone conduction indicates nerve deafness unless we can prove otherwise. On the other hand, there is no doubt that some obstructive lesions may diminish bone conduction at certain frequencies. Attention must repeatedly be called to this physical fact, because it is difficult for an otologist to abandon the old teachings. Even to admit the possibility of such a thing seems like throwing away the one solid rock on which we base a diagnosis of nerve deafness.

The human ear was not constructed to function normally or at maximum efficiency by bone conduction, although ordinarily fairly loud sounds may be so heard. For air conduction it is a perfect organ,

because the middle ear, which may be regarded as a sensitizing mechanism, transmits sound to the labyrinth better than is possible by bone conduction alone. (Note the subnormal hearing after a radical mastoidectomy.) But even then, although the meatus is completely blocked, hearing persists, and bone conduction is not notably diminished.

The function of the middle ear in bone conduction is probably important, but as yet it is not definitely understood.

ACCURACY OF MEASUREMENTS

Accurate measurements of bone conduction are seldom made, and yet there is a tendency to base a diagnosis on small changes. This is due to several reasons, but largely because of lack of time and of appreciation of the necessity. Is there any value in making accurate measurements? I find that under ideal testing conditions, bone conduction varies in normal ears about 8 seconds (14 sensation units), and in the ordinary testing room of the otologists from 20 to 30 sensation units from average normal (and at times a similar change up or down within a few moments). If this is true, then the fact that one ear is, say 8 seconds less than another, does not mean diminished bone conduction in the poorer ear, or increased bone conduction in the better ear. It is simply a normal variation. In order to attach any diagnostic importance, then, on an 8 second (14 sensation unit) diminution or increase in bone conduction, an otologist must know whether the standard to which he is comparing it is average normal, and if he uses his own bone conduction for his reference, he must know whether his own ear is high or low normal (if normal) or the exact loss in bone conduction.

Only by painstaking measurements of his own ear in comparison with similar measurements of a large number of other normal ears can this be done. In a noisy place, an examiner's normal ear is at a disadvantage when compared with a deafened ear, because the latter may not sense the noise, and so no masking of the testing sound occurs.

COMMENT

It is useful to make accurate measurements of bone conduction: (1) for the calibration of the ear of every examiner; (2) for the calibration of normal ears; (3) for comparison with air conduction (to make both with similar accuracy); (4) for keeping dependable histories so that the disease may be accurately diagnosed and followed; (5) for furnishing another curve with which to study the dynamics of the ear.

For a single primary diagnostic observation, extreme accuracy may not be so essential, but for the measurement of a change in bone conduction, great accuracy is of paramount importance. We do not know the original normal bone conduction of the ear examined, and if we fail to make an accurate primary test at subsequent examinations we shall not know what changes have occurred.

CAUSES OF ERRORS IN MEASURING BONE CONDUCTION BY TUNING FORKS

1. Observational: (*a*) From the position of the source of sound with respect to the ear (hence the mastoid should always be used); (*b*) from the variation in strength of the sound (due to variable reaction of the ear); (*c*) errors in reading the recording instrument (stop watch); (*d*) attention (several tests will demonstrate if skew); (*e*) accommodation (of small importance alone); (*f*) mentality of the observer (if poor, tests will be inaccurate: misinterpretation of feeling tone for hearing, etc., hence explain); (*g*) variation of technic of examiner (advisable always to use the same); (*h*) method of setting fork for minimum audibility (intermittent placements should be used); (*i*) interfering noise (examination should be made in quiet place or ears should be closed gently without hard pressure on tragus).

2. Sampling: (*a*) Variation with individuals (up to 8 seconds [14 sensation units]; thickness of muscle and scalp; enlarged glands beneath fork, scar tissue); (*b*) variation with time (up to 7 seconds [12 sensation units]); (*c*) variation with experience (patients train quickly); (*d*) variation with frequency and amount of tinnitus which causes masking.

3. Scale of Intensity: (*a*) In seconds or sensation units (every fork differs in intensity [same fork to be used], frequency, and purity of tone from every other fork, unless especially standardized and kept true; clamps or widened ends to prongs aid).

4. Abnormality: (*a*) Uncertainty of detecting defects (only a complete otologic examination can diminish this factor).

5. Age: (*a*) Between 50 and 70, bone conduction begins measurably to diminish due to (1) changes in mineral content of bones, (2) diminution in blood supply, (3) relaxing of tissues, hence lessened elasticity, (4) nerve deafness.

The relative proportions in which the before-mentioned errors enter into the determination of the normal depends on the care taken to minimize them. An actual quantitative investigation of each is impossible and unnecessary from the standpoint of otologic practice. In general, it may be stated that normal ears have been observed to vary as noted above. All errors may be minimized by care and attention to the notations following each error in the list above.

Bone conduction in abnormal ears is subject to the same errors as in normal ears, but some are more difficult to eliminate because it may be impossible to place a fork on the spot regularly used on account of tenderness, ulceration and wounds. The abnormal ear varies more than the normal (it is this variation which we desire to record). Attention

is distracted on account of pain, discomfort or worry. Accommodation is usually diminished. Mentality may be affected by the disease. Often the patient may feel and not hear the vibrations. In diseased ears purity of tone may be diminished by the lesions and also the frequency sensitivity may vary differently from the normal ear. The greater the complexities of the defects, the greater are the variations (crossed auditions are frequent and often are not detected).

UNITS OF MEASURE[1]

It has been repeatedly pointed out that the persistent practice of writing tuning fork findings in seconds (by air conduction) as fractions is not rational, because two widely differing forks may give the same fraction and yet really not indicate that the hearing losses as measured by each are equal, and vice versa, because the ratio will be found to be different for different forks. This also holds true for bone conduction.

For the sake of clarity, let us resolve our findings into sensation units or use a rational ratio expressed as a fraction. A method will presently be described which obtains a ratio for air and for bone conduction with tuning forks, and with which one may express the loss in hearing in seconds, sensation units or percentage of hearing as desired.

METHODS FOR MAKING ACCURATE MEASUREMENTS WITH TUNING FORKS

The most dependable and time saving technic in our hands has been as follows:

The physician stands directly in front of the patient, who is seated with the head firmly supported by a head rest. The fork is held lightly in the right hand and the flat side of the extremity of one blade is struck forcibly on a hocky puck, or just above the patella. For the high frequencies a piece of wood is used, or the prongs are snapped between the thumb and forefinger of the left hand, always employing the same force.

For bone conduction the shank is applied every three seconds slowly by firm deep pressure vertically against the mastoid three-fourths inch behind the ear, on a level with the superior meatal wall, as there is usually a slight depression and less padding on the skull at this point than in any other as convenient a location.

As the fork is struck, a split second double hand stop watch held in the left hand is started. This sets both hands in motion. If the air conduction is also to be recorded, the fork is placed before the meatus with the extremity of the flat side of one prong parallel to the side of the head, and the meatal and mastoid placements are alternated every one

1. Fowler and Wegel: Tr. Ann. Otol., Rhinol. & Laryngol., 1922. Fletcher, H.: Tr. Am. Otol. Soc., 1925.

and one-half second. If the fork is being applied to one ear for air conduction only, it may be alternated between the meatus and the scalp, or some convenient place of like damping effect.

The intermittent application enables us to avoid tiring the patient, increases accuracy by alternating sensation and lack of sensation, and largely eliminates errors due to the persistence of sound sensation after it has ceased. With bone conduction it also avoids the discomfort of constant pressure and one-half of the damping of the fork thereby. By deliberate and slow deep pressure, the danger of reactivating the fork by the shock of application is avoided and also any danger of not using the exact amount of pressure best suited to transmit the sound. Some forks may be set in vibration by slight shocks, the high frequencies often by the touch of a hair to a prong. If the pinnas are alike, it is good practice to gage the distance from the meatus by an imaginary line down the middle of the antihelix. The lateral presenting edge of the fork should be made to coincide with this line. Distance is important because sound increases and diminishes greatly, depending on the distance from its source.

The patient should be instructed to say "yes" or "no" as to whether he hears or does not hear the sound of the fork at each placement on the mastoid and before the meatus. The instant the patient says "no," the alternate placements should be continued, but one hand of the watch should be stopped by pressing the side button, allowing the other hand to proceed, until another "no" signals the examiner to press the stem button. One then knows definitely the number of seconds the fork was heard by air conduction, by bone conduction or by both, as the case may be.

There are other ways of measuring air and bone conduction, but only one or two will be mentioned here. The fork may be held constantly on the skull, or constantly before the ear, using the shank for the first and the prong for the latter mode of application (or the shank for both). This is, of course, equivalent to using two separate instruments for each kind of sound reception. It is as though we held a fork in the air and then on a sounding board. The vibrations of a fork are damped by contact with the skull, and so bone conduction is obtained with maximum damping, while the air conduction time would be obtained without damping.

The loss by damping my 256 double vibration fork held constantly on the skull, depending on how hard it is pressed, is equivalent to from 10 to 30 sensation units. This is roughly from 10 to 25 per cent. in loss of hearing.

It is easily seen that a large error will occur if bone conduction obtained by the damped fork is compared with air conduction obtained by the undamped fork held solely before the meatus.

The decrement of a tuning fork is a steady logarithmic diminution in sound intensity, whether the sound is heard by air or by bone conduction, by stem or by shank, so long as the damping remains the same. The damping is made the same by regularly placing the fork alternately on the mastoid and before the ear. There is no other way in which it can be made the same for air and bone conduction.

In the Rinné test (that is, the difference between perception by air and bone), one may use the alternate method, but it is customary to stop placing the fork on the mastoid or before the meatus when it ceases to be heard at either place, thus changing the rate of damping from there on.

There is a distinct difference between the Rinné difference, and the ratio between total air and bone conduction. The first is independent of the way the fork is set in motion and how hard it is hit; the length of time the fork is held on the skull and the damping thereby. The second depends on how hard the fork is hit and the way it is hit; the damping of the fork by construction, balance, length of time on skull, location (padding, etc.), and the variation between forks.

But for definite measurements of air and bone conduction, a ratio is obviously more serviceable than a difference, and therefore we advocate a standard method of activating, holding and applying tuning forks, each examiner making sufficient measurements with his own forks for this purpose.

We find that by such a method (as detailed before) the difference between air and bone conduction is constant for any ear for each fork (on the average), and this depends only on the ear and the amount of the fork's own damping.

A ratio is a comparison between two numbers or two magnitudes of the same kind. Therefore, if we are to compare two such magnitudes, we must apply the fork alternately to the skull and to the ear, not only during the time the ear hears it by bone conduction, but continually until hearing ceases by both air and bone conduction. If we do not do this, we are damping the fork more while applied to the bone, and we do not continue this damping subsequent to the cessation of hearing by bone conduction. If bone conduction were always the same, this would not so much matter, and it would not be necessary to continue the alternate application of the fork to the meatus and mastoid. But bone conduction may be diminished, and then if the fork is removed from the skull and applied before the ear, this will be done much sooner than in normal bone conduction. Hence it would be damped much less than normally, and so the fork would sound louder and longer than normally when it was placed before the meatus. The air conduction in such a case might appear normal and yet be markedly diminished, or with increased bone conduction, it might appear falsely diminished.

If the hearing of the tester is normal, or the loss is known, the hearing loss of the patient may be found also by the following method which has the advantage of not being dependent for its accuracy on the way the fork is struck. The fork may be set into any amount of vibration and the difference in time it is heard by the patient and the examiner may be measured. Then this difference may be multiplied in seconds by the constant of the fork (that is, the number of sensation units it dies down in 1 second). This gives the difference in sensation units between the hearing of the patient and the examiner. Tuning forks die down at different rates. If the rate of decrement is known, then the loss per second can be computed for this fork. The most convenient unit to use for this purpose is the sensation unit. For example, if the tester's hearing is normal and the patient's hearing loss is 20 seconds, and if one and three-fourths is the number of sensation units a 256 fork dies down in 1 second by the complete alternate method, then 20 seconds multiplied by 1.75 equals 35 sensation units, or 35 by 0.91 equals 31.8 per cent. loss in hearing (0.91 is the factor for converting hearing loss in sensation units into percentage hearing loss for my 256 double vibration fork.)

Using the complete alternate method of application for a combined Rinné and Schwabach test appears logical, economical of time and patience, and accurate. It gives a definite scientific reading of bone conduction and air conduction under the conditions. It sets the minimum audibility point apart from the prior sound reaching the ear, and thus determines it better.

It makes possible the recording of both air conduction and bone conduction, obtained with a single fork, in the same units of measure whether we use seconds or sensation units. It is the only method devised which makes this possible and with a single simple and inexpensive instrument.

All forks should be calibrated so that their readings may be compared with all other calibrated forks. In other words, the number of seconds of loss in hearing should be translated into sensation units so that all tests may be comparable.

METHODS OF AVERAGES

An average of a large number of measurements made at one time is more reproducible and dependable than any single measurement. The accuracy is proportional (according to the theory of probability) to the square root of the number of observations (that is, 16 measurements are twice as accurate as 4, since $\sqrt{16}$ equals 4 and $\sqrt{4}$ equals 2 and 2 is twice 4). Any desired accuracy may be obtained by making the requisite number of observations.

Table 1 is a record and analysis as to accuracy of ten observations made on bone conduction on a subject at one sitting. The times recorded with stop watch are given in the second column, the average time below the second column. The difference between the average time and each observation is given in the third column headed "Variations of Each from the Average." They are seen to vary from 1 to 3.8 seconds. The average deviation from the mean, however, is 2.2 seconds. This figure (2.2 seconds) may be taken as a measure of the probable accuracy of any of the observations since it shows the average variation from the mean (45 seconds).

TABLE 1.—*Illustration of Method of Computing the Accuracy of Ten Measurements*

Subject D. Bone conduction via Right Mastoid (Meatus Closed)

Number of Observations	Time Heard, Seconds	Variations of Each from the Average, Seconds
1	43.6	1.4
2	47.6	2.6
3	44.0	1.0
4	46.8	1.8
5	46.6	1.6
6	48.2	3.2
7	42.2	2.8
8	44.0	1.0
9	41.2	3.8
10	48.0	3.0
	45.0 Mean average	2.2 Average variation from mean

Summary

Number of observations	10
Average time heard	45.0 seconds
Average deviation	2.2
Accuracy of single measurement	45 ± 2.2
	Or from 42.8 to 47.2
(Variation from average)	$\frac{2.2}{\sqrt{10}} = 0.7$
Hence the accuracy of the average of 10 measurements	45.0 ± 0.7
	Or from 44.3 to 45.7

If the subject had been erratic, the deviations would have been greater and their average greater. Obviously the accuracy of the average is greater than that of any single reading. According to the theory of probability, the accuracy of the average of a number of observations is proportional to the square root of the number of observations made. In this case (ten observations) proportional to the $\sqrt{10.00}$ or 3.16 times as accurate as one observation. The figure representing the accuracy of the average is, therefore, obtained by dividing 2.2 (the accuracy of one observation) by 3.16. This gives an accuracy figure for the average of 0.7 seconds as compared with 2.2 seconds for a single observation.

If a large series of tests (of ten each) were made under the same conditions, the averages would be expected to vary by not more than

TABLE 2.—*Bone Conduction in Subject D*

Bone Conduction via Right Mastoid (Meatus Open)

No. of Observations	(Normal Ears) Observations, Seconds	Variations from Mean, Seconds
1	36.0	0.3
2	36.2	0.5
3	33.0	2.7
4	34.4	1.3
5	40.0	4.3
6	33.6	2.4
7	42.2	6.5
8	33.0	2.7
9	35.2	0.5
10	34.2	1.5
	35.7 Mean average	2.24 Average variation

Number of observations..... 10

Accuracy of single measurement..... 35.7 ± 2.24
Or from 33.46 to 37.94

Variation of average..... $\frac{2.24}{\sqrt{10}} = 0.7$

Therefore the accuracy of the average of 10 measurements..... 35.7 ± 0.7
Or from 35 to 36.4

Bone Conduction via Left Mastoid (Meatus Closed)

No. of Observations	(Normal Ears) Observations, Seconds	Variations from Mean, Seconds
1	49.6	3.8
2	44.0	1.8
3	48.2	2.4
4	45.2	0.6
5	48.2	2.4
6	44.8	1.0
7	40.0	5.8
8	49.6	3.8
9	44.8	1.0
10	42.0	2.2
	45.84 Mean average	2.48 Average variation

Accuracy of single measurement..... 45.8 ± 2.48
Or from 43.4 to 48.2

Variation of average..... $\frac{2.48}{\sqrt{10}} = 0.7$

Therefore the accuracy of the average of 10 measurements..... 45.8 ± 0.7
Or from 45.1 to 46.5

Bone Conduction Left Mastoid (Meatus Open)

No. of Observations	(Normal Ears) Observations, Seconds	Variations from Mean, Seconds
1	34.2	2.4
2	37.2	0.6
3	41.8	5.2
4	36.6	0.6
5	35.0	1.6
6	32.0	4.6
7	34.2	2.4
8	34.6	2.0
9	36.2	0.4
10	36.4	0.2
	36.6 Mean average	2.0 Average variation

Accuracy of single measurement..... 34.6 to 38.6

Variation of average..... $\frac{2.00}{\sqrt{10}} = 0.63$

Accuracy of average of 10 measurements..... 36 to 37.2

TABLE 2.—*Bone Conduction in Subject D—Continued*

Bone Conduction via Vertex (Meati Closed)

No. of Observations	(Normal Ears) Observations, Seconds	Variations from Mean, Seconds
1	42.6	0.2
2	42.6	0.2
3	38.6	4.2
4	41.6	0.8
5	42.6	0.2
6	42.8	0.4
7	44.2	1.8
8	46.0	3.6
9	40.6	1.8
10	43.6	0.6
	42.4 Mean average	1.38 Average variation

Accuracy of single measurement ..... 41.1 to 44.7

Variation of average ..... $\frac{1.38}{\sqrt{10}} = 0.44$

Accuracy of average of 10 measurements ..... 42.0 to 42.8

Bone Conduction via Vertex (Meati Open)

No. of Observations	(Normal Ears) Observations, Seconds	Variations from Mean, Seconds
1	34.2	0.1
2	36.6	2.5
3	37.2	3.1
4	36.8	2.7
5	31.0	3.1
6	35.0	0.9
7	31.0	3.1
8	32.0	2.1
9	34.2	0.1
	9) 308.0	9) 17.7
	34.2 Mean average	1.97 Average variation

Accuracy of single measurement ..... 32.23 to 36.17

Variation of average ..... $\frac{1.97}{\sqrt{9}} = \frac{1.97}{3} = 0.66$

Accuracy of average of 9 measurements ..... 33.4 to 34.8

Consolidation of Findings in Subject D

	Seconds
Difference in bone conduction, fork on vertex (meati open)	34.1 ± 0.66
(meati closed)	42.4 ± 0.44
Difference	8.3 ± 0.7
Difference in bone conduction, fork on vertex (meati open)	34.1 ± 0.66
fork on mastoid, left, (meati open)	36.6 ± 0.63
Difference	2.5 ± 0.8
fork on vertex (meati closed)	42.4 ± 0.44
fork on mastoid, left (meati closed)	45.8 ± 0.7
Difference	3.4 ± 0.8
Difference in bone conduction, fork on mastoid, right (meatus closed)	45.0 ± 0.7
(meatus open)	35.7 ± 0.7
Difference	9.3 ± 0.99
mastoid, left (meatus closed)	45.8 ± 1.4
(meatus open)	36.6 ± 0.63
Difference	9.2 ± 1.54
Average difference	9.3

TABLE 2.—*Bone Conduction in Subject D—Continued*

Summary of Conclusions, Bone Conduction	
Difference with fork on vertex between meati open and meati closed	8.3 ± 0.7
Difference between fork on vertex and fork on mastoid, left, open	2.5 ± 0.8
Difference between fork on vertex and fork on mastoid, left, closed	3.4 ± 0.8
Difference with fork on right mastoid between meatus, open and closed	9.3 ± 0.99
Difference with fork on left mastoid between meatus, open and closed	9.2 ± 1.54
Difference between differences with forks on right and left mastoids between meati open and closed	Nil
Average difference with fork on either mastoid, between meati open and closed	9.3 ± 1.27
Difference, fork on vertex between meati open and closed	8.3
Difference, fork on mastoids, meatus open and closed	9.3
With fork on mastoid difference is greater by	1.0 Av. Diff.
This is partly due to the increased time the fork is heard on the mastoid over a fork heard on the vertex	

0.7 seconds. Thus it is seen that the accuracy has been increased by making ten measurements from 2.2 to 0.7 seconds, or better than three times.

Similar accurate measurements of a few normal ears are recorded in Table 2, and the results of the computations interpreted.

These calculations should suffice to illustrate the method. The following data (Table 3) for Subject B will give only the averages, number

TABLE 3.—*Bone Conduction in Subject B, Normal Ears*

No. of Tests	Fork on Mastoid	Computed Accuracy	
5	Right	50.1 sec. ± 0.8 sec. or from 49.3 sec. to 50.9 sec., meatus closed	
5	Right	42.0 sec. ± 0.535 sec. or from 41.5 sec. to 42.5 sec., meatus open	
5	Left	49.5 sec. ± 0.53 sec. or from 48.96 sec. to 50.3 sec., meatus closed	
5	Left	41.5 sec. ± 0.96 sec. or from 40.5 sec. to 42.5 sec., meatus open	
Right ear difference between open and closed			8 sec. ± 1.44 sec.
Left ear difference between open and closed			8 sec. ± 1.13 sec.
7	Vertex	31.3 sec. ± 0.57 sec., meatus open	
5	Vertex	41.4 sec. ± 1.3 sec., meatus closed	
Vertex difference between meati open and meati closed			10.0 sec. ± 1.42 sec.
Difference between vertex (ears open)			31.3 sec. ± 0.57 sec.
left mastoid (ears open)			41.5 sec. ± 0.7 sec.
		Difference	10.0 sec. ± 0.85 sec.
Difference between vertex (ears closed)			41.3 sec. ± 1.3 sec.
and left mastoid (ears closed)			49.5 sec. ± 0.67 sec.
		Difference	8.2 sec. ± 1.46 sec.
Average difference, open or closed, between vertex and mastoid			9.1 sec. ± 1.16 sec.

of readings and computed accuracies, all for bone conduction with the same 256 double vibration fork.

Conclusions, Subject B (Bone Conduction).—1. Closing one or both ears increases duration of fork on mastoid from 14 to 16 sensation units, or from 8 to 9 seconds.

2. Closing the meatus gives the same increase with the fork on the vertex as with the fork on the mastoid.

3. The right and left ears give about the same increase on closing the meatus.

4. Between the vertex and the mastoid irrespective of the closure of the meatus, there is a difference of about 9 seconds (16 sensation units).

5. The meatal closure increases bone conduction about 9 seconds (16 sensation units), irrespective of where the fork is placed.

6. In this case the two ears may be considered equal.

7. No physical significance should be attached to the coincidence that the increase on closing the meatus is about the same as that in changing the fork from the vertex to the mastoid.

8. The increase obtained by closing the meatus is independent of the position of the forks.

9. Figured from the constants of the fork, and the difference in time, the fork gave roughly ten times the amplitude of motion to the ear mechanism when placed on the mastoid than when placed on the vertex.

10. Closing the meatus figured in the same way also gives an increase of ten times the amplitude of motion to the ear mechanism.

11. Several tests made by Runge's method (filling the meatus with 1 c.c. of water as detailed by Dr. J. W. Downey), indicate that the ear mechanism will vibrate by bone conduction from ten to twenty times as violently with as without the water filling (that is, it is from ten to twenty times more intense). It is conceivable that lesions producing similar mechanical effects might in the same manner increase bone conduction, but to date I have encountered none giving so marked an increase.

COMMENT

It is obviously desirable to limit the number of observations at each frequency and yet maintain a reasonable accuracy. A good practice is to make four or five observations and if none of these varies from the average more than three seconds, to stop further tests at this frequency unless greater accuracy is desired.

Although even five observations may appear burdensome compared to the usual one or two for air and for bone conduction, no more time is consumed, and twice the accuracy is obtained, because the method I have described measures both air and bone conduction with each excitation of the fork, and the data obtained are correlated so that we obtain a definite and rational measurement of hearing. In other words, we have, reasonably combined in one test, air conduction, bone conduction, Schwabach, Rinné and Weber and Bing (meatal closure) tests.

My own forks have been carefully calibrated so that I can plot a curve for air conduction and a curve for bone conduction in the same

audiogram, thus, so far as I know, for the first time making possible the plotting of two curves showing the vibratory characteristics of the ear, one for air and the other for bone conduction. Using the complete alternate method described, and the method of averages, many interesting facts have been obtained; but it seems advisable to defer their presentation until a later paper. I hope to do this.

SUMMARY

The usual methods of measuring bone conduction are inaccurate. There may be 8 seconds variation in a normal ear.

It is desirable to measure bone conduction accurately, rationally and in understandable units of measure so that measurements can be correlated and charted with air conduction.

A simple rational method of measuring both air conduction and bone conduction in this manner is described. It is based on making the decrement in intensity of tuning fork tone the same for air as for bone conduction (in other words, the damping is made the same for both).

This is accomplished by continuing to alternate the placement of the fork between the mastoid and the meatus until the sound ceases to be heard by both. Advantages and variations of the method are noted. Tuning forks should be calibrated so that all tests may be in the same units of measure. A method for obtaining any desired accuracy by employing the law of probability with calculations illustrating normal cases, and some experiments show that:

1. An accuracy of less than a second's variation was obtained in the subjects tested (less than 2 sensation units).

2. Closing the meatus causes the same increase in bone conduction whether the fork is on the vertex or mastoid or on any other part of the skull.

3. This increase with a 256 double vibration fork was about 9 seconds (16 sensation units).

4. This increase is equivalent to an increase of ten times in amplitude.

5. A similar difference exists between vertex and mastoid placement of the fork.

6. Runge's water filling method causes an increase in amplitude of ten to twenty times the normal.

7. No lesions causing this amount of increase have been encountered.

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OTOMYCOSIS

REPORT OF NINE CASES TREATED WITH POTASSIUM IODID

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INTRODUCTION

The present article is prompted by the belief that mycotic infections of the ear occur more frequently than is generally supposed, and by the conviction that the present forms of treatment are often inadequate to effect a cure. We wish to report nine cases of this disease treated by the oral administration of large doses of potassium iodid in combination with local treatment and, in addition, four cases treated by local measures only. Nine of the thirteen cases were observed by us during the last year, since we have been especially interested in otomycosis.[1] We are, therefore, led to believe that we have been overlooking this condition in the past because of failure to make a careful search for mycelia and spores in chronic conditions of the external auditory canal and the middle ear.

HISTORICAL

It has long been known that various fungi, which are normally saprophytic, occasionally become parasitic in man. They may be found as causative agents or secondary invaders in various skin diseases, and more rarely in conditions affecting the eye and ear, the upper and lower respiratory tracts, the digestive tract and the urethra. In 1867, the medical profession first became generally aware of the fact that fungi might cause aural disease. In that year Schwartze [2] reported a case of otitis externa in which aspergillus was found. Prof. J. Vogel made the microscopic examination in this case, and he called Schwartze's attention to the fact that two cases had previously been reported, one by Mayer [3] in 1844 and one by Pacini [4] in 1851. In his article Schwartze remarks: "It appears to be very probable that this vegetable parasite is more frequently a cause of obstinate, frequently relapsing and chronic

1. Four additional cases have come under our observation while this report was being prepared. Two were seen in private practice and two in dispensary practice, during July, 1925.

2. Schwartze, H.: Pilzuncherung (aspergillus) im äusseren Gehörgang, Arch. f. Ohrenh. **2**:5-7, 1867.

3. Mayer: Beobachtungen von Cysten mit Fadenpilzen aus dem äusseren Gehörgange, Müller's Arch., 1844, p. 401.

4. Pacini: Supra una muffa parasita nel condatto auditivo esterna, 1851, Firenze.

inflammation of the ear than is generally supposed." In 1868, one year later, Robert Wreden [5] of St. Petersburgh reported six cases, and shortly after published a monograph [6] in which he reported fourteen cases and gave a very complete account of the appearance of the fungus. In 1873, St. John Roosa [7] in his "Practical Treatise on Diseases of the Ear" discussed this new found disease at great length, and practically every textbook of otology thereafter has included otomycosis in its chapter on diseases of the external auditory canal. "The Manual of Tropical Medicine" by Castellani and Chalmers,[8] states that otomycosis is fairly common in the tropics. In India, Hatch and Row [9] observed twenty-two cases in one month during the rainy season. It also seems to be common in Russia, but if one may judge by the literature it is rather uncommon on the continent and in this country. A search of the *Index Medicus* for 1923 revealed only two papers [10] on the subject,[11] each one in French and each reporting only one case. In addition, there was one German article [12] dealing with the cultural reactions of *Aspergillus* and *Penicillium*.

THE FUNGUS

The fungi with which we are concerned all belong to two families—*Mucoraceae* and *Aspergillaceae*. In the latter family are included two genera, namely, *Penicillium* and *Aspergillus*, seventeen species of which are pathogenic in man. Ten different species have been reported in ear conditions, by far the most common among them being *Aspergillus fumigatus*. In this paper we do not intend to discuss the methods of identification of the various species. In fact, according to Castellani and Chalmers,[8] when these saprophytes become parasites they often lose their characteristics and it may be impossible to identify a given species with certainty. As saprophytes they are extremely common: (*a*) *Mucor* being found on bread; (*b*) *Penicillium* on bread, cheese, fruits and various organic substances in a state of decomposition, and (*c*) *Aspergillus* on cereals, straw, hay, etc. As a result of this distri-

5. Wreden, R.: Sechs Fälle von Myringomykosis, Arch. f. Ohrenh. **3**:1, 1868.

6. Wreden, R.: Die Myringomykosis aspergillina, St. Petersburg.

7. Roosa, D. B. St. John: Treatise on Diseases of the Ear, New York, William Wood & Company, 1873, pp. 132-144.

8. Castellani and Chalmers: Manual of Tropical Medicine, New York, William Wood & Company, 1920.

9. Hatch and Row: Fungus Disease of the Ear, Lancet **2**:1561-1564, 1900.

10. Galavielle and Cazejust: Un cas d'otomycose aspergillaire, Bull. d. sc. pharmacol. **29**:438, 1922.

11. Langeron, M.: Sur un champignon d'une otomycose bresilienn, sterigmatocystis hortei n. sp., Bull. soc. path. exot. **15**:383, 1922.

12. Butkerwitsch: Ueber die Bildung der Citronensäure in den Kulturen von Aspergillus niger und Penicillium glaucum auf Zucker, Biochem. Ztschr. **126**: 224-237, 1923.

bution one might suspect that housewives would perhaps be more exposed to infection than others, and this is suggested by our short series of cases which includes eleven women and two men. On the other hand, most of the textbooks state that the disease occurs more often in men, and among people who live in dirty, unhygienic surroundings. Of our cases only three might fairly be included in the latter classification. Five patients were observed in the Johns Hopkins Hospital Dispensary and the remaining eight in private practice.

FACTORS PREDISPOSING TO INFECTION

In the ear, the fungus is probably never a primary invader but occurs secondary to some other pathologic condition. After it has once gained a foothold, however, it may persist after the primary condition has disappeared entirely or become masked by it. In order to thrive, the fungus requires moisture, and this may be supplied in the ear by the following conditions: (*a*) Maceration of the skin as the result of trauma or long soaking in water, (*b*) eczema and furunculosis of the canal, (*c*) slight chronic discharge from the middle ear. If the middle ear discharge is profuse, it would tend to wash the fungus out of the canal before it could gain a foothold. In chronic otitis media, with perforation of the drum and scanty discharge, the middle ear affords a good medium for its growth. It is readily seen that such ears might be infected by the use of contaminated irrigation solutions. Practically all the textbooks discuss otomycosis under the heading of otitis externa only, and do not mention the possibility of middle ear involvement. In fact, the usual synonym for otomycosis is otitis externa parasitica. In the literature, however, there are reports by Maggiora,[8] Gradenigo,[8] Siebenmann,[8] Forsyth [13] and others, in which mycelia and spores were found in cases of acute and chronic otitis media. In our series of thirteen cases, the fungus infected the middle ear alone in three cases, and the middle ear as well as the external auditory canal in three other cases.

PATHOLOGY

Plaut [14] states that the fungus may occasionally be found growing on the cerumen in a healthy ear, and that it is only of pathologic significance when the skin is involved. Having once obtained a foothold on the moist or macerated epithelium of the canal or of the middle ear, the fungus proliferates rapidly and tends to penetrate the deeper tissues. According to Castellani,[8] it sets up an inflammatory reaction with serous exudation due to mechanical irritation and also to toxins secreted by the

13. Forsyth, J. M.: Tropical Ear, Ann. Trop. Med. **18**:61 (April 30) 1924.
14. Kolle, W., and Wassermann, A.: Handbuch der pathogenen Mikroorganismen, Jena **5**:33-34, 1913.

fungus. This toxin may cause intense reaction in the skin of the canal, and lead to necrosis and perforation of the ear drum in patients who did not have middle ear disease previously. Plaut [14] states that when the drum is involved, the disease occasionally leads to perforation. Such an invasion occurred in Cases 6 and 13 of our series, while the patients were under observation. In Case 5 it may have been the cause of the perforation, as no history of previous middle ear disease could be obtained either from the patient or from her family. In our other three patients with middle ear involvement, there was a definite history of otitis media in early life. In Hatch and Row's series of twenty-two cases, only one showed middle ear involvement and this patient was known to have had preexisting middle ear disease. In cases of middle ear infection, it may be difficult to determine, at first, whether the fungus plays the primary rôle or whether it is merely a secondary invader. After it has reached the middle ear, it is natural to suppose that it may also extend into the mastoid cells. Case 5 of our series probably had such an involvement of the mastoid. We could find no cases in the literature in which there was serious mastoid involvement, or in which there were labyrinthine or intracranial complications.

SYMPTOMATOLOGY

If the fungus grows superficially it may cause no symptoms whatever, or perhaps only a slight itching and later a feeling of fulness and impairment of hearing due to mechanical obstruction of the canal. In such cases, if the patient scratches the ear or tries to clean out the canal, trauma so inflicted promotes penetration to the deeper tissues. This may be followed by intense itching, swelling of the canal, tenderness and dull pain. The patient may also experience recurrent attacks of severe pain. One of our patients had had an upper molar tooth extracted because of severe pain in the ear which was supposed to be of dental origin. In another, the tonsils had been removed because of pain radiating down the neck. When the canal alone is involved it will contain dry scales and crusts, but there is usually no discharge from the ear. However, if discharge is present, it is scanty, thick, flaky and not mucopurulent in character. When the middle ear is involved, there is considerable discharge mixed with mucus. In Case 5, the discharge was constant and foul smelling. The color of the scales, crusts or discharge largely depends on the species of fungus, it can be black, brown, yellow or white.

Hatch and Row [9] divided their cases into two types: (*a*) the wet or eczematous type with discharge and furuncles, and (*b*) the dry type with crusts.

The most common symptom is dull pain. If untreated, the condition may last for years and even when there is an apparent cure, recurrence is frequent, as the spores are very resistant and long lived. We know of one case in which there was a recurrence after twenty years of comparative freedom from symptoms. The patient is an eminent bacteriologist. He identified the fungus himself, and found the same species in a cast removed from his external auditory canal twenty years after the initial attack. Two of our patients had recurrences after a year of absolute freedom from symptoms.

DIAGNOSIS

The diagnosis is based: (*a*) on the history (that in Case 2 is typical). (*b*) On the finding of scales, flakes, crusts or thick, whitish, yellowish, or brownish discharge in the canal. The scales often adhere tightly to the canal wall and the drum, and are difficult to remove. It is usually impossible to remove them all at one sitting. In some cases, they are confined to the inner third of the canal and the drum. (*c*) On the red, macerated appearance of the skin after removal of the scales and crusts from the canal. (*d*) Most important, by the finding of mycelia and spores in a smear made from the material removed. This often requires careful search. It is best to add 10 per cent. sodium hydroxid to the material, seal the cover glass with petrolatum and allow it to stand over night in order to dissolve the abundant epithelial débris. (*e*) By cultures, on Sabouraud's agar or Raulin's liquid. The article by Hatch and Row [9] contains a discussion of the cultural reactions. In cases of chronic middle ear involvement, there may be no characteristic signs except the microscopic picture.

Patients who give a history of eczema or intermittant furunculosis of the canal should be suspected especially. The condition of the canal leads the patient to scratch and traumatize it, thereby encouraging the invasion of staphylococci with resultant furunculosis. The healing furuncles in turn give the fungi an opportunity to penetrate into the deeper tissues and so aggravate the chronic condition. Of our seven patients in whom the external auditory canal alone was involved, four ascribed the onset of their trouble to a boil in the ear. From the history alone, however, it is difficult to say with certainty whether the acute attacks were caused by a true furunculosis. Two of the patients in this group were seen during an acute attack. In one there was a staphylococcic infection. It masked the mycotic infection, which was only discovered after the furuncle had healed. In the other, mycelia and spores but no staphylococci were found. In this patient the acute symptoms seemed to be due to a sudden invasion of the deeper tissues by the fungus. It is noteworthy that in our cases the onset of symptoms invariably occurred during the warmer months of the year.

TREATMENT

In 1851, Paccini[4] treated his case with lead acetate. In 1868, Wreden[5] suggested alcohol, mercuric chlorid, tincture of iodin, phenol (carbolic acid) and solution of potassium arsenite (Fowler's solution), but preferred chlorinated lime. Roosa,[7] in 1873, advocated strong silver nitrate applications. Later a solution of salicylic acid or boric acid in alcohol came to be widely used. Theobald,[15] in 1898, protested against the use of pure alcohol or alcoholic solutions, and reported patients cured by insufflation of equal parts of boric acid and zinc oxid powder. Hatch and Row[9] prefer irrigations with iodoform and boric acid. The agents most commonly in use at the present time are: (*a*) 2 per cent. solution of salicylic acid in 70 per cent. alcohol, (*b*) 95 per cent. alcohol alone, (*c*) silver nitrate solution, (*d*) boric acid and zinc oxid powder and (*e*) alcoholic solutions of bichlorid. Schamberg and Kolmer,[16] as the result of test tube experiments on the fungistatic and fungicidal activity of various dyes and drugs, classified them as follows: (*a*) iodin (inferior in aqueous solution), (*b*) sodium oxymercury-orthonitro phenolate (best fungicide in test tube), (*c*) crystal violet (best of aniline dyes, but inferior to the foregoing), (*d*) salicylic acid (poor fungicide in test tube). They considered the clinical results reported as due to the exfoliative effects of salicylic acid rather than to its fungicidal influence.

In our experience, a 2 per cent. solution of salicylic acid in 70 per cent. alcohol alone does not give satisfactory results, though we used it in most of our cases in combination with potassium iodid internally. One patient (Case 11) was treated thoroughly and carefully for several weeks with the salicylic acid solution combined with less frequent applications of 10 per cent. silver nitrate. There was no appreciable improvement. Before this patient came under observation, she had received various forms of local treatment for otomycosis by otologists in other cities. It is natural to suppose that after the fungi have penetrated the deeper tissues, it would be difficult to reach them by local applications alone.

We have been unable to discover in any textbook of otology a recommendation to use potassium iodid in cases of otomycosis. Its employment was suggested by the well known fact that it is often used as a remedy in other mycotic infections. The following plan of treatment was evolved:

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15. Theobald, S.: Treatment of Otomycosis by Insufflation of Boracic Acid and Oxide of Zinc, Bull. Johns Hopkins Hosp. **9**:251, 1898.

16. Schamberg, J. F., and Kolmer, J. A.: Studies in Chemotherapy of Fungus Infections. 1. The Fungistatic and Fungicidal Activity of Various Dyes and Medicaments, Arch. Dermat. & Syph. **6**:746-756 (Dec.) 1922.

1. Oral administration of potassium iodid, beginning with 5 grains three times a day, and increasing gradually to 15 grains or more three times a day. This course to be continued until the symptoms are relieved and the ear is free of discharge.

2. A period of ten to fourteen days, preferably under observation, during which time the patient takes no potassium iodid but is instructed to wipe out the canal daily with alcohol or with a 2 per cent. solution of salicylic acid in alcohol.

3. A fourteen day course of potassium iodid then follows, beginning with 10 grains three times a day and rapidly increasing to the maximum dosage the patient can tolerate.

4. Rest for two weeks and repeat the fourteen day course of potassium iodid. In obstinate and long standing cases, two week courses with two week intervals between should be continued for at least six months.

5. It is important that no water should be allowed to enter the canal at any time and that no oils or ointments should be used in the ear.

Some persons develop a rash or other symptoms of iodism before the optimum dosage is reached, as in Cases 2 and 4. In such an event the doses of potassium iodid must be kept relatively small.

The better results obtained by courses of potassium iodid are probably due to the fact that the spores are not killed by the drug, but are prevented from developing. The interval between courses allows the spores to develop into mycelia which are then killed by the next course.

It is undoubtedly true that when the fungus is growing superficially it can be cured by local measures only. When it has penetrated beneath the skin we believe potassium iodid to be essential. We include a report of four patients treated by local applications alone. In one there was no improvement while under observation (Case 11); in another the symptoms persisted for six months and then cleared up (Case 12). This is in striking contrast with the rapid relief of symptoms in the patients treated with potassium iodid. As may be seen in the case reports, we tried various drugs locally, but are inclined to believe that 95 per cent. alcohol, or a 2 per cent. solution of salicylic acid in 70 per cent. alcohol are the most useful.

In cases of middle ear disease when mycelia and spores are found in the discharge, the question as to whether the fungus plays the primary rôle can be determined by a therapeutic test. All of our patients who received adequate treatment as outlined in the foregoing were cured. However, when the fungus occurs merely as a secondary invader, the discharge from the middle ear will persist after mycelia

and spores can no longer be found in it. In such an event the patient will then have to be treated the same as any other case of chronic middle ear suppuration.

REPORT OF CASES

CASE 1.—Mrs. S., white, housewife, aged 47, was seen on Feb. 5, 1923, with the complaint of itching and discomfort in both ears.

Present Illness.—The first symptom was itching, with onset August, 1922. The ears felt stopped up, and the hearing had been somewhat impaired with associated tinnitus and intermittent pain. She has had no treatment.

Past History.—There has been no history of previous trouble with the ears. The patient had frequent attacks of tonsillitis in childhood. Occasional attacks of vertigo for the last year were attributed to high blood pressure. For about six months, the patient has had right sided nasal obstruction and much postnasal discharge with occasional pain over the right eye.

Examination.—The skin of both vestibules of the ears was dry and scaly. There was slight swelling and induration of the left canal. Both canals were filled with whitish scales and crusts, adherent to canals and drums. Both drums were intact, opaque and injected. The hearing was about 15/20 in both ears. A smear showed many mycelia and spores, and culture showed *Penicillium.*

Diagnosis.—Otomycosis and chronic sinusitis involving the right frontal, ethmoids and antrum, with nasal polypi and much deflected nasal septum (the patient was unwilling to have any treatment for this condition).

Treatment.—Six applications of 10 per cent. silver nitrate were given at the office. Two per cent. solution salicylic acid in 70 per cent. alcohol was given twice daily at home from February 12 to March 7. From 10 to 16 minims of potassium iodid was given three times a day from February 12 to March 21.

Result.—The patient showed steady improvement from February 12 to March 14, when the canals appeared normal for the first time. She was discharged as cured March 21, 1923, about five weeks after beginning treatment.

Recurrence.—The patient returned one year later on March 18, 1924, saying she had had no trouble with her ears from March, 1923, to February, 1924, but for the last month they felt stopped up and the left ear had been discharging every night. There has been no pain, and the nose and throat symptoms were unchanged. Examination of the ears showed that the right canal contained a few scales. The drum was intact and opaque. The canal of the left ear was filled with thick, yellowish-white secretion. No scales or swelling were present. The drum was intact. A smear from the left canal showed many mycelia and spores of *Penicillium.*

Treatment.—Three applications of 1 per cent. gentian violet were given at the office. Two per cent. salicylic acid in alcohol was given twice daily at home. Increasing doses (16 minims) of potassium iodid was given three times a day.

Result.—The ears looked normal April 8, three weeks after the second course of treatment was begun. The patient was advised to continue salicylic acid for two weeks and potassium iodid for one month longer.

Subsequent Note.—The patient returned one month later, May 5, with the ears normal, but complaining of great increase in nasal symptoms with much discharge, right frontal headache and pains in joints. These symptoms have gradually increased during the last month, that is, while taking large doses of potassium iodid. There was no history of acute upper respiratory infection to account for this flare-up of the sinus infection. Infecting organisms were streptococcus and *Staphylococcus aureus.* It is possible that the staphylococcic infection was stirred up by the potassium iodid. Since May, 1924, the patient has been under treatment for the sinus infection and the ears have been examined from time to time. There has been no recurrence of the ear condition during the last year.

CASE 2.—R., white, a man, aged 29, was seen May 27, 1924, with a complaint of dull pain and swelling of the left ear.

Present Illness.—About two years ago, the patient had a succession of "boils" in the left ear. Ever since, he has noticed constant discomfort and slight swelling around the ear. He has had intermittant attacks of pain but no discharge and no impairment of hearing. (This is the good ear.) This man has been deaf in the right ear since childhood. At onset, there was a marked swelling all around the ear and several incisions were made in the canal. Following this, the patient was treated at an Ear, Nose and Throat Dispensary for several months without any improvement after the acute symptoms subsided. Since then he has had irregular and intermittant local treatment in various dispensaries and by several physicians without improvement. Two weeks ago, a left upper tooth was extracted in an effort to relieve the pain in the left ear.

Past History.—The patient had frequent attacks of acute tonsillitis in childhood, when a polypus was removed from the right ear, and ever since he has been deaf in that ear. There was no history of any previous trouble with the left ear.

Examination.—The drum of the right ear was very much scarred; there was an old dry perforation in Schrapnell's membrane. The canal was normal. The canal of the left ear was slightly swollen and indurated, narrowing the lumen of the meatus about one-half. The glands below the mastoid tip were slightly enlarged and tender. The inner half of the canal and drum were covered with brownish material resembling cerumen, but it was crusty, adherent and difficult to remove by either curet or irrigation. It was found impossible to remove all of it at one sitting. The smear from material removed showed many mycelia and spores of *Penicillium.* The patient was advised to use glycerin drops three times a day, and two days later he returned for removal of the remainder of the material. It was then found that there was a small round perforation in Schrapnell's membrane, filled with brownish white scales. The nose was normal. The tonsils were greatly enlarged and adherent.

Treatment.—Ten per cent. silver nitrate was given by local applications, later 1 per cent. mercurochrome-220 soluble. Two per cent. salicylic acid in alcohol was used for four weeks, then discontinued. The patient could apparently take only 8 minims of potassium iodid, and over this dose developed symptoms of iodism. He was careless in following instructions and took the potassium iodid very irregularly. Nevertheless he regarded himself cured five weeks later, the pain and induration had entirely disappeared and there was no discharge from the ear. The canal, however, was still covered by a thin film of whitish material, which contained mycelia and spores. After July 3, he returned irregularly two or three times a month until September 4. On that date the left ear was free of scales for the first time and looked perfectly normal. The patient was advised to take ten day courses of potassium iodid and return in six weeks for observation. He returned in July, 1925, with a recurrence of the trouble.

CASE 3.—Mrs. O., white, housewife, aged 55, was seen July 2, 1924, with a complaint of pain in the right ear.

Present Illness.—The acute symptoms occurred two weeks prior to examination, with pain, swelling and later intermittent discharge from the right ear. The patient had been irrigating the ear with boric acid solution at home. The pain was very severe during the last two days. She had been having intermittent trouble with the right ear since September, 1923, when she developed a "boil" in it with much pain and swelling. Since then she has had a succession of boils in the right ear.

Past History.—This patient never had any trouble with the left ear and no trouble with the right ear prior to September, 1923.

Examination.—The left ear was normal. The right ear showed swelling anterior to the tragus; it was very tender on pressure over the tragus and on manipulation of the auricle. The canal was filled with pus, discharging furuncles

on the floor of the vestibule. The canal and drum were very red. The drum was intact, not bulging. The hearing was slightly impaired. The condition was diagnosed as a furuncle and the canal was cleaned with alcohol followed by 1 per cent. mercurochrome-220 soluble. The patient was advised to discontinue the irrigations and to use heat externally.

She returned three days later free of symptoms, the furuncle had healed, the drum was intact, but still there was a small amount of discharge in the canal, which was red and slightly swollen. Otomycosis should have been suspected then and a smear made, but the condition was not diagnosed until July 21, eighteen days later, when the patient returned complaining that the right ear had been sore and painful again for five days.

Examination.—The canal was filled with thick, whitish discharge without odor, mixed with dark granules. The epithelium of the canal and drum was excoriated and red, there were no furuncles. The glands below the ear were slightly enlarged and tender. Smear revealed many mycelia and sprouting spores of *Mucor.*

Treatment.—Local applications of 1 per cent. mercurochrome-220 soluble were given. Two per cent. of salicylic acid in alcohol was given twice daily and used for two weeks. From 5 to 15 minims of potassium iodid were given three times a day for one month constantly, followed by intermittent fourteen day courses until December.

Result.—All symptoms were relieved after two weeks. Since then there has been no discharge and no pain. The canal has been practically free from scales after three weeks and entirely free after four weeks. The patient returned for observation October 15, and on that date the canal looked normal except for one small area on the posterior wall, covered with a thin brownish crust. A smear from this showed many epithelial cells and a few mycelia. On December 15, the canal was normal in appearance. One month later it was also normal.

CASE 4.—Mrs. W., white, housewife, aged 25, was first seen Sept. 30, 1922, with an acute left middle ear infection, as a result of getting bath water in an old chronic condition, with a large defect in the drum. This acute attack cleared up in about one week. There was a history of scarlet fever in childhood complicated by a severe infection of the left ear. Since then there has been an intermittent discharge from the left ear, but without attacks resembling the present one. The patient was not seen again until August, 1924, when she complained of intermittent discharge from the left ear, without pain or other symptoms.

Examination.—The right ear was normal. The left had a large defect in the drum, the canal and middle ear were inflamed, there was a small amount of dark brownish discharge. Smear showed mycelia and spores of *Penicillium.*

Treatment.—From 6 to 10 minims of potassium iodid were given in interrupted courses. Over this dosage the patient invariably developed a severe pustular iodid rash. The patient has been cleaning the canal with an alcohol swab daily.

The result showed a rapid clearing up of the discharge with a recurrence, however, in October, and about once a month thereafter until March 11, 1925, the discharge lasting for about twenty-four hours and containing mycelia and spores. In March, she was able to increase the dose of potassium iodid to 20 minims, and since then she has been free of symptoms. On May 15, she was apparently cured.

CASE 5.—A. W., a woman, white, aged 45, was seen in August, 1919. She complained of foul smelling, dark brown, intermittent discharge from the right ear for a duration of six years. There was no history of middle ear disease in childhood. The onset of discharge was not associated with acute symptoms. She has been treated by several good otologists with various forms of local treatment for middle ear disease, but without improvement. The discharge was so foul smelling and the patient was so sensitive about it that she became a recluse during the periods of discharge.

Examination.—The drum of the right ear showed a large defect. There was a dark brown foul smelling discharge in the canal and middle ear. Smear showed many mycelia and spores of *Mucor*. Culture showed *Mucor*.

Treatment.—Alcohol drops were given locally. Courses of potassium iodid were given in increasing doses to 20 grains three times a day.

The result was a rapid cessation of the discharge which cleared up entirely in about one month. Since 1919, the patient had two transient recurrences which cleared up rapidly under potassium iodid and alcohol. This case is an excellent illustration of the value of making a search for mycelia and spores in chronic middle ear disease.

CASE 6.—E. M., a maid, colored, employed at the Johns Hopkins Hospital, came to the hospital dispensary July 3, 1924, with a complaint of pain in the right ear for the duration of several days. The patient was treated in the dispensary April 24, for acute tonsillitis and at that time there is a note that the ears were normal. This patient had frequent sore throat. She had no previous ear trouble.

Examination.—There was a whitish moldy looking discharge in the right canal. Crusts were clinging to the drum, which was not seen. It was cleaned with alcohol and hydrogen peroxid. On July 8, five days later, a similar condition was present in the left ear. Following this, the patient was given local treatment with alcohol and 1 per cent. mercurochrome-220 soluble until August 30, when the right ear was reported clear and both drums intact. On August 30, the left canal was filled with whitish discharge, a smear of which revealed numerous mycelia and spores of *Penicillium*. On September 11, the patient returned with pulsating discharge in the left ear and a perforation in the drum. The right ear was normal. September 13, there was very little discharge in the left ear but a large perforation in the drum. The patient was given potassium iodid.

Treatment.—Local treatments of alcohol and 1 per cent. mercurochrome-220 soluble were given. The right ear cleared up in eight weeks. Potassium iodid was given after the left ear had been involved for ten weeks.

After September 13, the patient did not return to the dispensary again until she was sent for on November 6. She stated that she had been taking potassium iodid fairly regularly and had noticed a steady improvement in the ear condition, but had had occasional scanty discharge from the left ear.

Examination.—The right ear drum looked normal. There were a few scales in the canal. The hearing was normal. The drum of the left ear was dull, there was a large round perforation in the posterior inferior quadrant through which inflamed and polypoid mucous membrane protruded. A smear made from discharge wiped from the perforation showed mycelia and spores. The hearing was remarkably good, about 18/20. The patient was advised to continue potassium iodid. She took treatment irregularly and it was difficult to persuade her to return to the dispensary for observation. She finally did return March 31, 1925. Examination revealed that both canals were normal. The left drum was intact and the hearing was normal. There were no symptoms except occasional itching. The canals were dry and no material could be found from which to make a smear. The patient said that she considered herself cured after the last course of potassium iodid. In this case the infection in the right ear improved under local treatment alone, while that in the left ear progressed and perforated the drum. Under potassium iodid and without any local treatment the left ear healed. The patient was last seen on May 7, 1925, when she was well, but was advised to continue courses of potassium iodid and return once a month for observation.

CASE 7.—E. V., white, a girl, aged 16, was seen Nov. 18, 1924, at Johns Hopkins Hospital Dispensary, with the complaint of discharge from the left ear, with onset three weeks prior to examination, with discharge and dull pain in the ear. There were no other symptoms, and the patient had had no previous trouble with the ears.

Examination.—The glands were enlarged at the angles of the jaw. The teeth were in a poor condition. Chronic tonsillitis and large adenoids were present. The nose and sinuses were clear. The right ear was normal, the left had a whitish discharge and scales, and the canal was red. The drum was not seen. Smear showed mycelia and spores of *Penicillium.*

Treatment.—The patient was given hydrogen peroxid and alcohol drops.

On November 25, she was much better. The canal was red, and there was very little discharge. The drum was intact and potassium iodid was given. This patient did not return for further treatment and could not be traced.

CASE 8.—M. R., a waitress, colored, aged 18, came to the Johns Hopkins Hospital Dispensary April 3, 1925, with a complaint of pain in the left ear.

Present Illness.—April 1, the patient had pain in the left ear, which was shortly followed by a small amount of discharge. There were no other symptoms. The pain was dull in character and not severe. The patient had no previous trouble with the ears except occasional itching. She thinks the present attack may have been induced by scratching the ear with a hairpin.

Examination.—There was one enlarged gland below the tip of the left mastoid. Chronic tonsillitis was present. The skin of both vestibules of the ears was scaly, thickened and presented a typical picture of eczema. The right canal contained a small amount of thick whitish discharge. The skin of the canal was very red, and the drum was intact. The left canal was filled with thick, foul smelling material, the skin ulcerated and bled easily. The drum was intact.

Diagnosis.—At first sight the condition was diagnosed as eczema of the external auditory canals, and the patient was given yellow mercuric oxid ointment. Because of the appearance of the left canal, a search was made for diphtheria bacilli, but none were found.

The patient returned to the dispensary April 21, saying that she considered herself cured until April 20, when the pain in the left ear recurred. At the second examination it was found that the eczematous condition of the vestibules had entirely cleared up, but the appearance of the canals was unchanged. A smear of the foul smelling discharge in the left canal revealed many mycelia and spores of *Mucor.*

Treatment.—The canals were cleaned with alcohol. Two per cent. of salicylic acid in alcohol and potassium iodid were given.

May 7, the patient was entirely free of symptoms. A few scales remained in both canals. May 14, the patient continued free of symptoms; both canals looked clean. The patient was told to continue the courses of potassium iodid and to return every two weeks for observation.

CASE 9.—W. M., a salesman, white, aged 47, came to the Johns Hopkins Hospital Dispensary May 15, 1925, with a complaint of loss of voice and discharge from the left ear.

Present Illness.—Eighteen years ago, the patient had an acute attack of otitis media with spontaneous rupture of the left ear drum. He lived in the country and did not see a physician. Since then he has had intermittent discharge and occasional attacks of pain, radiating down the neck. The discharge was never profuse and the patient irrigated the ear himself with sodium chlorid solution. The immediate cause of his coming to the Dispensary was a sudden loss of voice on May 14, when he came home and found his wife acutely ill. About one year ago, he was involved in financial difficulties and lost his voice for nine weeks.

Examination.—The larynx showed bilateral adductor palsy, otherwise it was normal. The right ear was normal. The left drum was almost entirely destroyed. The canal and middle ear were very red. There was a small amount of thick discharge mixed with brownish material resembling cerumen. Smear showed cholesterin crystals, abundant mycelia and brown spores, some sprouting of *Aspergillus.* The diagnosis was otomycosis and hysterical aphonia.

Treatment.—The canal was cleaned with alcohol. The patient was given 2 per cent. salicylic acid in alcohol locally and potassium iodid internally. The irrigations were discontinued. In this case the mycotic infection was evidently superimposed on a chronic suppurative otitis media through the agency of unsterile irrigations. It is too soon to determine the result of treatment.

REPORT OF FOUR CASES NOT TREATED WITH POTASSIUM IODID

CASE 10.—R. K., a woman, white, was referred for examination of the ears, nose and throat on March 25, 1925, with a complaint of discharge from both ears. The onset had occurred in July, 1924, with pain and swelling in both ears, described as "boils." Following rupture and discharge, the pain and swelling disappeared. Ever since, the patient has had more or less constant scanty yellowish white discharge which she finds when she cleans her ears. Itching and occasional attacks of dull pain and slight preauricular swelling were present. She has had no previous trouble with the ears other than earaches in childhood. She has had intermittent local treatment without improvement.

Examination.—The glands were not enlarged. The nose and throat were normal. There was slight swelling of the external auditory meatus of the ears and preauricular tenderness of the left. Both canals contained a small amount of thick yellowish white discharge. There was very little reaction in the skin. The drums were intact and the hearing was normal. Smear showed mycelia and spores of *Aspergillus.* This patient was in the private ward of the Johns Hopkins Hospital with a complication of diseases. As the ear condition was of minor importance it was not treated.

CASE 11.—McF., a woman, white, aged 50, was a psychoneurotic patient seen in a nursing home in May, 1921, with a complaint of intermittent pain and constant discharge from the left ear for about two years. Otomycosis was diagnosed about one year ago, and since then various methods of local treatment at home, in hospitals and in sanatoriums have been tried.

Examination.—The right ear was normal; the left ear canal was filled with thick whitish discharge, with scales clinging to the canal wall and the drum, which was intact. Smear showed mycelia and spores of *Aspergillus.*

Treatment.—Ten per cent. silver nitrate applications were given to the canal three times a week, during the patient's three weeks' stay in Baltimore. Two per cent. of salicylic acid in alcohol was instilled into the ear by her nurse three times a day for three weeks.

Result.—There was no improvement while under observation. The subsequent course was unknown as the patient left the city and the case could not be followed up.

CASE 12.—B., a graduate nurse, was seen in July, 1922, with a complaint of pain in the right ear, fever and malaise. The onset was sudden, with a rise in temperature to 103 F. and two chills. There was severe pain in the right ear with swelling of the canal and great tenderness on manipulation of the auricle. The general examination was negative. There was no other condition to account for chills and fever. At first the diagnosis was furunculosis of the canal, but smear showed mycelia, spores of *Aspergillus* and no staphylococci.

Treatment.—The patient was kept in bed for three days, when the acute symptoms subsided. Heat externally and aluminum acetate tampons were given. After the acute symptoms subsided, the patient was seen several times a week and 10 per cent. of silver nitrate was applied to the canal. The patient cleansed the canal twice daily with an alcohol swab.

Result.—There was gradual improvement, but the patient was not completely cured until January, 1923, six months later. Since then, there has been no recurrence, according to the patient's statement.

CASE 13.—A. Z., white, a housewife, aged 34, came to the Johns Hopkins Hospital Dispensary, Oct. 7, 1924, with a complaint of soreness in the left side of the neck.

Present Illness.—The patient had scarlet fever at 19, since then she has had impairment of hearing and tinnitus, but no discharge from the ears. There has been intermittent soreness on the left side of neck for several years. There was no history of tonsillitis.

Examination.—The nose and throat were normal. The drums of the ears were scarred and covered with calcareous deposits. A small amount of epithelial débris and brownish material were removed from both canals, leaving bleeding areas. A smear was made at this time, but, unfortunately, it was lost. The patient was advised to return for further observation and treatment.

She returned May 7, 1925, seven months later, saying that she had become dissatisfied after her first visit and had gone elsewhere. About Oct. 15, 1924, the tonsils and adenoids were removed and a nasal operation was performed at another hospital. The ear symptoms and the soreness in the neck were not relieved by these measures. A few days ago the left ear began to discharge.

Examination disclosed that the right ear was dry, and the drum intact. The canal was normal. The left ear had a small amount of thick greenish brown discharge and a large defect in the drum. The canal and middle ear were very red. Smear revealed masses of mycelia and brownish spores, some sprouting, of *Aspergillus.* Culture showed *B. proteus.*

Treatment.—The canal was cleaned with alcohol and 1 per cent. mercurochrome-220 soluble was applied. The patient was directed to return the following day, but has not been seen since. She has, therefore, received no adequate treatment. The case is included in this report because of the interesting history, and the invasion of the middle ear subsequent to the patient's first visit to the dispensary.

SUMMARY

In conclusion, we believe: 1. That otomycosis is more common than is usually suspected and that in consequence a correct diagnosis is not always made. This is particularly true when the middle ear is involved.

2. That it should be definitely ruled out by careful microscopic examination in all cases of eczema and recurrent furunculosis of the external auditory canal, and in atypical or long standing discharge from the middle ear, particularly when such discharge is of a brown or dirty white color.

3. That the use of large doses of potassium iodid internally is a most valuable adjunct to any form of local treatment, and that it should be given in courses over a long period of time to obtain the best results.

4. That potassium iodid should be used with caution when the patient has a concomitant staphylococcic infection, because of its apparent inhibitory effect on the normal resistance to skin cocci.

5. That the disease is prone to recur after apparent cure. Therefore, to estimate the value of any form of treatment, the patient must be followed up for at least three months, preferably much longer.

CONCOMITANCE OF SINUSITIS AND BRONCHIECTASIS *

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In the present investigation, designed to establish the relation, if any, between sinusitis and bronchiectasis, I first perused the literature published on the subject to ascertain the ideas of predecessors in the field, and then studied cases of bronchiectasis at Dr. Chevalier Jackson's bronchoscopic clinics of the University of Pennsylvania Hospital and Jefferson Hospital in Philadelphia.

It is believed that a reading of the thoughts of others show that all of them have had some sound ideas on the subject. All of those selected claim a relationship between the two. Some attribute a causal rôle to sinusitis, others merely note the relationship. One, Dr. W. V. Mullin,[1] states that every case of bronchiectasis that came under his observation was accompanied by sinusitis.

The study of the previously published material in the field, coupled with the practical knowledge obtained through the study of eight actual cases of bronchiectasis, have resulted in the author's acceptance of some of the ideas previously set forth and the rejection of others. The conclusions in this thesis, therefore, will, in part, represent confirmed theories of others, and for the remainder my own reflections on the subject.

St. Clair Thomson was one of the first to call attention to the subject of this study. Discussing the complication of sinuses disease he says, "The same cause (nasal and sinus suppuration) often explains the inveteracy of bronchorrhea."

Rist pointed out the association of chronic bronchial cough with chronic disease of the nasal sinuses. This investigator compared the respiratory tract with the urinary tract, cystitis being so frequently the consequence of renal infection.

Sergent reported that incorrect diagnosis had been made in one third of the cases of supposedly tuberculous soldiers, and that most of these mistakes occurred in men in whom a more thorough investigation demonstrated chronic bronchitis, associated with chronic infection of the nose or of the nasal sinuses. Both Rist and Sergent insisted that correction of the nasal disease brought about cure of the bronchitis.

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1. Mullin, W. V.: The Lymph Drainage of the Accessory Nasal Sinuses, Tr. Am. Laryngol., 1919.

In 1919, Webb referred to the failure of internists to realize the dependancy of many forms of bronchiectasis and chronic bronchitis on disease of the accessory sinuses.

W. V. Mullin,[1] in his paper entitled "The Accessory Sinuses as an Etiologic Factor in Bronchiectasis," makes the following statement: "Patients with bronchiectasis will usually be found to have a well marked sinusitis, and the degree of the bronchial infection is usually in proportion to the amount of sinus involvement present." We have been able to prove the first part of this claim, since sinus involvement was present in a good proportion of the patients with bronchiectasis treated in the bronchoscopic clinics at the University Hospital and Jefferson Hospital.

In going over some of the authoritative literature on bronchiectasis, I have not noted such an association mentioned, but, as Mullin says, "brain abscess as a relatively frequent complication of bronchiectasis is mentioned." Granted that brain abscess is a frequent complication of sinus diseases, do not the bronchiectatic subjects, in whom this complication is found, develop it not from their bronchi but from an unrecognized sinusitis? Reviewing the recent literature in this field, the only writers who have done experimental work with the object of demonstrating the routes which connect the accessory sinuses with the lungs and bronchii are Mullin and Ryder.

In the first series of experiments on rabbits by the use of carbon suspension and tubercle bacillus emulsion, they showed that the lymph drainage of the antrum is by way of the submaxillary and deep cervical nodes. From these nodes drainage passes onward by the cervical lymph ducts, the great veins, the right side of the heart, and the pulmonary artery to the lungs. The frontal sinuses appear to drain by the same route.

Mullin and Ryder [2] inoculated rabbits in the antrum with pneumococci from a human infected antrum, and produced inflammation of the maxillary sinuses, intense tracheitis, bronchitis and pneumonia.

In a second series of experiments, they injected india ink or bacterial suspensions into the nasal fossae. Pigmentation or lesion of the antrum and lung were produced simultaneously, proving that inhalation of these substances had occurred.

In short, they established that by two routes the accessory sinuses may infect the lung and bronchi, namely,

1. The lymphatic or circulatory route, which can function even in the case of an antrum which does not discharge at all into the nose.

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2. Mullin, W. V., and Ryder, C. J.: Studies in the Lymph Drainage of the Upper Air Passages and Accessory Sinuses, Laryngoscope **31**:158 (March) 1921.

2. The inhalation or bronchial route which is open to any substance reaching the nasal fossae from the accessory sinuses or elsewhere, provided it is converted into droplets or aspirated by sudden inspiration.

In a recent work, Hedblom, as evidence that the majority of post-tonsillectomy lung suppurations are due to the aspiration of infected blood during or following operation, says that Myerson, in 100 patients in whom tonsillectomy was performed under general anesthesia, by means of direct laryngoscopy and bronchoscopy, succeeded in finding blood in the trachea and bronchii.

The study made by Myerson seems to be a clear proof that the purulent secretion in the nasopharynx may, when the sufferer is sleeping, be inhaled and reach the bronchial tree, since he is in a state quite similar to the patient under general anesthesia who, after tonsillectomy, inhales blood infected or not.

Sinus infection and acute bronchitis may develop simultaneously, since many of the etiologic factors of sinusitis (coryza, influenza, pneumonia, diphtheria, scarlet fever, measles and smallpox) may attack, more or less at the same time, the entire respiratory tract. But if resolution does not occur in the affected paranasal sinuses, a chronic purulent condition is established, the pus by its continual dropping into the nasopharynx and inhalation through the air passages becomes the reason why the acute bronchitis is converted into a chronic one and the latter in time gives rise to bronchiectasis. The natural tendency is for bronchitis to undergo complete resolution unless fostered and fed by the chronic sinus infection.

Clending supports the claims set forth in this thesis in a recent article in the *Annals of Clinical Medicine,* September, 1924. He says that physicians recognize that many cardiac, vascular and renal lesions come from infections of the sinus or tonsil, but the idea of connection between nasal and respiratory disease has not been properly emphasized. The infection of the bronchial mucosa is a process of long duration. Early in the process of the disease, the patients, if young, are likely to complain, if they complain at all, of nothing except a succession of colds during the winter season and of easy susceptibility to chest colds. Later, however, this bronchitis and bronchorrhea may be continuous in the winter time and still later it may exist all the year round. In a later stage, occurring when the resiliency of the tissue has diminished, the terminal bronchioli become infiltrated and their walls and adjacent alveoli break down, forming pockets of pus with the familiar clinical picture of chronic bronchiectasis.

Webb and Gilbert [3] made roentgen-ray examinations of the accessory sinuses in all patients with chest disease, when the sputum repeatedly proved negative to the Koch bacillus. According to these authors, few cases of bronchiectasis or of chronic bronchitis have been found in which chronic infection of the accessory sinuses was not evident. Bilateral empyema of the antrum of Highmore was the most frequently encountered, but at times all the sinuses were involved. The pus yielded by the opening or washing of the sinuses usually contained pneumococci similar to those found in the sputum.

REPORT OF CASES

CASE 1.—A. L., a youth, aged 18, was admitted to the Jefferson Hospital in July, 1924, complaining of cough with expectoration. There was a history of measles in childhood, diphtheria, and influenza in 1918. Tonsillectomy under ether was performed about six years prior to examination. The patient stated that he has had a cough with expectoration since he was 2 years old.

Physical Examination.—Pus was seen in both sides of the nose. The nasal septum deviated to the left. There was a polyp springing from the right middle turbinate. Both tonsillar fossae were clean. The lingual tonsil was injected and hypertrophied. The mucous membrane of the larynx and trachea were injected. The clinical examination of the chest indicated a bronchiectasis of the right lung affecting the upper and middle lobe. The roentgen-ray examination confirmed the diagnosis.

In November, a radical operation was performed on the right maxillary antrum.

The patient was seen again in January, 1925, and was found to be greatly improved. He no longer had the morning cough with profuse expectoration. The amount of expectoration for twenty-four hours has been cut in half.

CASE 2.—A. S., a woman, aged 24, who complained of paroxysmal coughing with profuse expectoration of foul smelling pus, of about five years duration, was admitted to the bronchoscopic clinic at the Jefferson Hospital, in March, 1924.

History.—The patient remembered having chickenpox, measles and whooping cough, and pneumonia in 1918. She dated the beginning of the cough about ten years prior to examination, following an attack of grip. There was no complaint of sinus pain, but there was a profuse mucopurulent discharge from the nose.

Physical Examination.—The nose showed moderate deviation of the septum. There was hypertrophy of both middle turbinates, and a small amount of secretion was present. Postnasal examination showed marked hypertrophy of the posterior extremities of the inferior turbinates. The tonsils were enlarged with sharply defined injection of both anterior pillars. The roentgenogram showed a marked cloudiness of the right ethmoid as well as a slight cloudiness of the right frontal sinus and antrum.

Dr. McCrae made the diagnosis of bronchiectasis. The roentgenogram showed tuberculous lesions of the apices of both lungs and peribronchial lesions of both lower lobes.

Endoscopic Diagnosis.—Lung suppuration with bronchiecstasis of both lower lobes. The culture showed a growth largely of streptococcus. A diagnostic puncture of both maxillary sinuses was made and pus was found in the right antrum.

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3. Webb, G. B., and Gilbert, G. B.: Bronchiectasis and Bronchitis Associated with Accessory Nasal Disease, J. A. M. A. **76**:714 (March 12) 1921.

The antrum was washed several times, and each time a considerable quantity of pus appeared in the wash. Argyrol and mercurochrome-220 soluble were dropped into the antrum.

The patient has had several bronchoscopies for the purpose of drainage and medication by gomenol swabs in the diseased bronchial area. A radical antrum operation was advised.

The condition of the sinus and the bronchi was greatly improved as a result of treatment but the patient did not return to the clinic.

CASE 3.—B. L., a boy, aged 13 years, complained of cough with expectoration of a moderate amount of purulent sputum, which was very fetid. No definite history of any childhood disease or serious illness could be obtained.

The present illness dated from 1918. The patient was in the tuberculous ward of the Philadelphia General Hospital for drainage of empyema. While there, an operation of unknown nature was performed on the nose. The boy had two tonsillectomies with ether anesthesia. In January, 1924, the patient was admitted to the bronchoscopic clinic at the Jefferson Hospital.

Physical Examination.—The nose showed a considerable amount of mucopurulent secretion on both sides. The roentgen-ray report showed a thickening of the mucus membrane of the right antrum. The needle puncture lavage revealed a large quantity of very foul pus.

On examination of the chest Dr. Funk made the diagnosis of pulmonary fibrosis with localized lung suppuration, probably bronchiectasis, of the left lower lobe. Roentgen-ray examination of the chest revealed fibrosis and probably cavities in the left lower lobe. The bronchoscopic diagnosis confirmed the previous diagnosis of lung suppuration of the left lower lobe. The patient had several antrum punctures with washes and bronchoscopic treatments, and was discharged in June. The general condition was good. The amount of expectoration was distinctly decreased from about 50 c.c. on admission to 10 or 15 c.c. per day. Continued washings have been recommended, but patient did not always appear at suggested times.

CASE 4.—*History.*—L. P., a man, aged 21, came to the bronchoscopic clinic at the Jefferson Hospital in March, 1924, complaining of cough with expectoration, which had a disagreeable odor. The patient remembered having measles, but no other childhood disease. He had pleurisy followed by empyema in 1922.

While under treatment he began to complain of coughing produced by postnasal discharge and frontal headaches in the morning, and a drawing feeling over the bridge of the nose.

The examination of the nose showed that the nasal mucosa was very congested, with mucopus in the middle meatus of both sides and in the superior meatus of the left side. The nasal septum was slightly deflected to the right, a ridge in the left side impinging against the middle turbinate. There was a postnasal purulent discharge. The roentgen-ray report showed an exudative process of the right ethmoid, slight clouding of both maxillary sinuses which was more marked on the left side, and probably the sphenoid sinus was involved.

The lavage of both maxillary antrums with needle puncture brought a small amount of thin pus which mixed with the water. The lavage was repeated three times, but the last two yielded no pus.

On examination of the chest Dr. Funk gave the following diagnosis: "The lesion present is probably a diffuse fibrosis, considerable bronchitis and perhaps bronchiectasis in either the lower part of the left upper lobe or the upper part of the left lower lobe."

April 5, a bronchoscopy for diagnostic purpose was made, which showed a chronic suppurative bronchitis with mild degree of bronchiectasis in the left lower lobe bronchi. The culture of a swab from the bronchus showed practically pure growth of streptococcus.

In December, we performed a submucus resection of the septum. The after-treatment was continued, with plugs of 10 per cent. argyrol in the nose. The amount of discharge was diminishing progressively and the headaches, of which he had begun to complain, disappeared.

Bronchoscopic treatment was continued and the bronchial condition was very much improved.

CASE 5.—*History.*—L. M., a woman, aged 20, complained of cough, with expectoration which was slightly colored and had a foul odor. The patient had whooping cough, but did not remember having any other childhood disease. She had pneumonia and smallpox about six years prior to examination. Tonsillectomy with local anesthesia was performed five years prior to examination.

The patient dated the onset of her trouble from the whooping cough when she was aged about 10 years. She had a very annoying cough at that time. The expectoration was not present until recently.

The nasal examination showed that the septum was negative. Several mucous polyps were present in the anterior part of the middle meatus. The frontal sinuses were negative by transillumination. The same method of examination was applied to the maxillary sinuses and was a little indefinite in its results, but the left maxillary was not so clear as the right. There was a small amount of pus in the left side of the nose, but so diffused as not to point toward any special sinus. A considerable quantity of pus was found on the posterior wall of the nasopharynx and the oropharynx. The tonsils had been removed.

The roentgen-ray examination of the sinuses showed that no evidence of frontal sinuses could be found. They were, at least, very small, and whether they were occluded or not by abnormal contents could not be determined.

There was dense clouding on both sides of the ethmoid region. There was clouding on both sides of the maxillary sinuses, but more on the left than on the right. The sphenoid sinuses were somewhat clouded.

On examination of the chest the diagnosis made by Dr. McCrae was of a diffuse bronchiectasis. The roentgenogram showed cavities in the lower lobe of both sides of a bronchiectatic nature and numerous small abscess cavities.

Bronchoscopic diagnosis, made by Dr. Jackson, was: "Lung suppuration of both lower lobes," Remarks.—"The patient would be benefited by bronchoscopic treatments, aspiration and medication."

The patient had a number of bronchoscopic treatments. The condition at the last treatment, in December, 1924, showed great improvement, but even then she had not quite recovered; exenteration of the ethmoid cells was advised.

CASE 6.—*History.*—R. S., a woman, aged 23, complaining of pain in right side of the chest and cough with expectoration, was admitted to the Jefferson Hospital in October, 1923. The patient had measles when a child; pneumonia when 8 years old; influenza three years prior to examination and the tonsils and adenoids were removed in 1911. In 1921, she had an operation on the right frontal, ethmoid and right maxillary antrum. In 1923, she consulted Dr. Skillern, who made the diagnosis of pansinusitis. The roentgen-ray report showed a general cloudiness of all the sinuses. The examination of the cultures from all the sinuses showed an organism in pure culture which was also present in the sputum in large numbers. The organism seemed to be of the *Bacillus mucosus capsulatus* group. A vaccine was prepared from this organism.

The roentgen-ray examination of the chest, made by Dr. Pancoast, showed a cavity in the right lower lobe close to the mediastinum, which seemed bronchiectatic rather than a result of abscess.

This patient had a number of bronchoscopic treatments and her condition in December, when she was discharged, was very much improved, but a small quantity of whitish pus could be removed from the right main bronchus. Under the care of Dr. Skillern, the sinuses improved so much that the sinusitis was considered cured.

CASE 7.—*History.*—R. S., a woman, aged 31, was admitted to the University Hospital in January, 1924. The patient stated that her trouble dated back to a tonsillectomy (under ether) performed about two years ago. However, for several months prior to this, she had felt "run down" and had been troubled by slight coughing. Her doctor advised her to have the tonsils removed. After the operation, she developed some discomfort in the right upper side of the chest, with a severe cough, and raised a quantity of purulent material, which was at times blood-streaked. She had about five attacks of hemoptysis.

She has suffered from headache almost every afternoon, which affected chiefly the right side of the head. As a child she had mumps, measles and whooping cough. In 1920, she had an attack of influenza and pneumonia. Seven years ago, she had a thyroidectomy.

Physical examination of the chest yielded a diagnosis of abscess in the lower right lobe, possibly superimposed on an old tuberculous process. The roentgen-ray report of the chest was as follows: "There is an old process at the right apex, possibly tubercular in origin. In addition, there is also a very dense shadow to the right of the heart, the exact identity of which is uncertain."

The patient was sent to the Jackson Clinic for bronchoscopic diagnosis, which was "lung abscess in middle and lower right lobes.

Bronchoscopic drainage and medication (gomenol and mercurochrome-220 soluble) was thought advisable and has been continued up to the time this paper was written.

On examination, pus was seen on the floor of the nose, and in the middle meatus of both sides. The roentgenogram of the sinuses showed cloudiness of the left maxillary antrum. The patient was referred to the Nose and Throat Clinic and there both antrums were washed, but pus was extracted only from the left side. This treatment, together with bronchoscopic treatments, continued up to the time of writing, and marked improvement was noted in the patient's condition.

CASE 8.—*History.*—M. M., a woman, aged 51, came to the Jefferson Hospital in June, 1924, complaining of persistent cough with profuse expectoration, dyspnea and some huskiness on speaking. She did not remember having had the usual diseases of childhood.

The patient dates her illness to an attack of influenza in May, 1923. About one month later, the cough was so productive and annoying that she went to the Polyclinic Hospital. In June, 1924, she was referred to the bronchoscopic clinic for bronchoscopic diagnosis and treatment.

Physical Examination.—The nose showed a considerable amount of purulent discharge and marked crustings about both middle turbinates. The roentgen-ray studies of the sinuses showed a pansinusitis. There was extensive pyorrhea with gingivitis. The tonsils were small and fibrous. There was generalized injection of the mucous membrane of the larynx and the trachea.

On examining the chest, Dr. E. Beardsley reported the following: "The physical signs seem to indicate bronchiectasis of the left lung both in the upper and lower lobe. It is difficult to interpret the physical signs in the upper lobe because of an associated bronchitis." The roentgen-ray examination of the chest confirmed this diagnosis.

Although there was evidence of some bronchial involvement, at that time it was not believed advisable to perform a bronchoscopy because of the sinus infection, and the patient was referred to the Polyclinic Hospital for treatment of the pansinusitis. After the sinuses have been treated, bronchoscopic treatment may be given. At the time of writing, the patient was still undergoing sinus treatment.

CONCLUSIONS

1. The examination of a patient suffering from chronic bronchitis is never complete without a careful investigation of the upper respiratory tract. Many patients did not give definite enough symptoms to arouse suspicion, but a careful investigation showed the existence of sinusitis.

2. The theory that a chronic sinusitis may be an etiologic factor in bronchitis and bronchiectasis, appears perfectly tenable and may occur as Mullin believes, either (a) through the lymph vascular system, or (b) by direct inhalation.

But, however attractive a hypothesis this may be, none of the patients investigated for this thesis showed any recollection of symptoms of acute or chronic sinusitis preceding the attack of bronchiectasis.

3. Bronchitis is often a cause of bronchiectasis, and the bronchitis and sinusitis are in great part the same. Measles, scarlet fever, grip, whooping cough, etc., are recognized as causes of both. It is my opinion that since most of the cases under my observation complained of coughs dating back to some one of these diseases in childhood, that the sinus infection occurred at this time, but the symptoms of sinusitis were overshadowed by the general systemic condition.

4. I believe, therefore, that sinusitis and bronchitis are frequently of simultaneous origin, and therefore no causal property may axiomatically be attributed to sinusitis when it exists together with bronchiectasis. I do believe, however, that once both are in existence they exert an influence on one another. This is especially true in the sense that sinusitis affects bronchiectasis. The treatment of bronchiectasis is strengthened by treating the sinus at the same time.

5. This leads to the fifth and final conclusion, that in cases of bronchiectasis which are accompanied by sinusitis, the sinuses as well as the lung condition should be given the proper treatment.

PIGMENTED HAIRY NEVUS OF THE NOSE

WITH PIGMENTED HAIRY AND WARTY NEVUS OF THE CHEEK AND LIP

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The case that I report does not offer anything very new with regard to the operative procedure employed to remove the nevus in question. I shall draw a comparison between the different surgical methods at our disposal, and at the same time say a few words on the use of physical agents for this kind of condition. In choosing autoplasty, I was especially influenced by works of my master, Morestin, and the experiences I personally acquired in facial surgery during the recent war.

REPORT OF CASE

History.—Miss A. M., aged 19, consulted me on Jan. 24, 1920, on account of a pigmented hairy nevus of the face. Aside from the fact that this was a congenital condition, there was nothing in her personal or hereditary antecedents of any interest.

Examination.—This revealed the fact that the nose on both sides was covered with smooth pigmented areas, on which were implanted numerous hairy follicles. These irregular areas began at the orifice of the nostrils and ended at the root of the nose near the inner canthi and eyebrows, and the pigmentation ended in front of the groove between the nose and cheek on the left side. The nose was very much increased in volume, especially in the lower part, and notably on the right.

The right cheek was covered by a vast hairy and warty, blackish nevus, fairly regular in form. It could justly be compared to a rectangle resting on the nose, being 7 cm. long by 4 cm. wide. Its upper limit spread over the cheek in the direction of the ear, about 12 mm. from the ciliary edge of the lower eyelid in its middle part.

The right side of the upper lip likewise was covered with a pigmented hairy and warty nevus joining that of the cheek. Near the ala of the nose there was a small band of healthy skin. The right half of the lip was increased in size and somewhat lowered; this condition rendered the mouth slightly asymmetric.

The skin of the two latter nevi was very thick and ridged; it contained numerous protuberances and very much resembled that of a pachyderm.

The hairs implanted on the facial lesion were thick, hard and wiry, for the patient had for a long time habitually cut them every time they grew long There was no nevus on any other part of the body.

There was nothing of interest to be observed by anterior rhinoscopy or by examination of the pharynx.

In the presence of this condition, which constituted a repelling deformity (Fig. 1, taken January 26) I proposed surgical intervention, after having advised the patient as to the multiplicity of the operations that would be necessary in order to obtain a cure. The proposed intervention was eagerly accepted.

Course.—On January 27, I commenced the treatment of the cheek and lip, which was to consist of a series of excisions of portions of the involved area, taking great care not to stretch the skin beyond its natural resistance. With the exception of the rhinoplasty, during which the patient was completely anesthetized by chloroform, I used a solution of procain-epinephrin as a local anesthetic. By means of horizontal elliptic incisions on the cheek, vertical and oblique on the lip, I dissected off three flaps of skin in the middle part of the nevi. Dissection was practiced with a great deal of care so as not to leave any hair follicles in the wound. The hemorrhage was insignificant. Sutures and dressings were of the ordinary kind. At the end of eight days the last stitches were taken out.

On February 10, I repeated the operation at the same places. The aspect of the patient had already improved, as may be seen from Figure 2, taken on March 18.

Fig. 1.—Appearance of patient when first seen.

After the intervention on the lip on March 20, at the same sitting I removed that part of the nevus which was situated in the outer region of the cheek, representing an ellipse with a long vertical axis.

On April 10 and May 1, I continued the excisions, and the patient then went to stay with her family in the country for several months.

On her return in October, she had the appearance shown in Figure 3, taken on October 21.

At that time the limit of the extension of the skin of the cheek was reached, and if I had continued the gradual reduction of the nevus I would surely have had the eversion of the lower eyelid, and the raising of the corresponding upper lip. Therefore I decided to resort to dermo-epidermic grafting.

On October 23, I removed the upper half of the nevus of the cheek, which had become much diminished in volume, as far as the nasal groove. Great

Fig. 2.—Improvement of patient's appearance.

Fig. 3.—Further improvement.

care was observed in taking away entirely the cicatricial tissue resulting from the previous operations, in order to allow the best possible nutrition to the graft. It remained then only for me to supply a graft to cover a loss of tissue of about 4 cm. long by 2 cm. wide. To affect this, I cut from the left arm a thin dermo-epidermic graft about a fourth part larger than the flap of the cheek that had been removed. After having checked the hemorrhage, this graft was rapidly placed on the wound of the face, and was carefully sutured with silk by means of a fine conjunctival needle. In order to protect the graft against all traction when the dressings were renewed, I applied a layer of perforated gauze soaked in a preparation composed of paraffin, castor oil and Peruvian balsam. I immobilized the eyelids as much as possible by means of a compressive dressing. Having next loosened the skin surrounding the brachial incision, I easily coapted the lips with silk-worm gut, and applied an ordinary dressing.

Fig. 4.—Appearance of patient on Feb. 20, 1921.

Everything proceeded in a normal manner, and I had the satisfaction of seeing that the graft, which adhered well to the subjacent tissues, was in an excellent state of vitality.

On December 4, I again removed two fragments of skin at the lip, which represented the extreme limit of my excision without modifying the symmetry of the mouth by exaggerated tractions.

On December 18, judging that the time had arrived for removing all that remained of the nevus of the cheek and lip, I practiced a Thiersch graft taken from the arm. I took great care in the restoration of the lip to preserve the normal anatomic design of the mucous membrane. This time I again applied a paraffin dressing and prescribed absolute rest so as to keep the mouth in as

complete a condition of immobility as possible. The graft adhered well to the places where it had been applied, and I continued the dressings, taking all the necessary precautions to avoid infection by the nostrils. The cure gradually followed its course, and two months after the operation the two wounds were properly healed. The grafted skin, which was very solid, was level with the surrounding tissues, and no depression existed where the nevi used to be. In correcting the depression of the upper lip on the right, I endeavored to obtain perfect symmetry with the opposite side. The lower eyelid underwent no traction, and on Feb. 20, 1921, the patient had the appearance indicated in Figure 4.[1]

1. At this time the patient, still under treatment, was presented to La Société Médicale de Montréal, at a meeting held on Feb. 15, 1921.

It remained for me, finally, to remove the nevus from the nose. I then had recourse to the only procedure that could justifiably be employed in a case similar to this, namely, the Italian method. On February 24, the patient having

Fig. 5.—Appearance of graft eighteen days after further operation.

been anesthesized by chloroform, I made a minute ablation of all the affected integument on two thirds of the upper part of the nose, commencing at the intersuperciliary region. A large pedunculated flap was next cut from opposite the right biceps, to fill up the nasal wound. The incision in the arm, susceptible of rejoining, was rapidly loosened and coapted with silk-worm gut. The head, being already turned to the right, the brachial graft, which included a layer of adipose tissue of sufficient thickness to aid nutrition, was in its turn carefully sutured with silk to the denuded nasal region.

Two days before the operation, aided by my confrère, Dr. A. Saint-Pierre, I had prepared a plaster bandage to go around the chin and thoroughly immobilize the head, which was slightly inclined and directed to the right. A

gutter, also made of plaster, had been prepared, extending from the wrist to the armpit. The application of this gutter held the hand to the summit of the occiput, permitting me, when the flap was sutured and the dressing terminated, to immobilize the arm rapidly in a perfect manner by means of several turns of plaster bandages, holding the arm and head firmly together.

Everything went on normally during the fifteen days following the operation, the patient supporting the bandage without complaint. The sutures at the intersuperciliary region and on the left side of the nose were gradually removed, and the brachial flap adapted itself thoroughly at the grafting place. Eighteen days after the operation, the graft had the appearance shown in Figure 5.

Finding the time had arrived for completing the operation, the next day, under a general anesthetic, I cut the pedicle of the flap, aided again this time by Dr. Saint-Pierre. I removed the plaster apparatus and made a careful dissection of the nevus of the lower third of the nose, particularly in the region of the nostrils. After having almost entirely denuded the graft of its

Fig. 6.—Scars have practically disappeared.

adipose tissue, I sutured it carefully to the lips of the wound by striving to preserve the normal appearance of the tip of the nose as much as possible. The sutures on the right had naturally been removed, and I proceeded to rectify the line of coaptation of the brachial flap on the two sides. Finally, I applied a light compressed nasal dressing, and a dressing on the arm, after having diminished the size of the wound by appropriate sutures. This part of the graft adhered very well to the subjacent tissues, and the cure rapidly followed its course.

The epidermis formed on the arm little by little.

In order to diminish the volume of the nose and to hasten as much as possible the disappearance of the adipose tissue of the flap, at the end of

March I commenced to make compressed dressings with that malleable English composition called stent, the advantages of which I described recently in a work relating to a case of traumatic scoliosis of the nose treated by osteoclasis.

On April 28, the patient returned to her family and remained away for a year. At that date, the epidermis had formed wholly on the arm, and the nose was also thinner.

She returned on May 1, 1922, in order to have the treatment completed. There still remained two small brownish spots that I had left in the groove between the nose and the cheek. After excising them on May 3, I immediately practiced the Thiersch graft. This, like the preceding one, produced an excellent result. As the fatty tissue lining the flap was gradually reabsorbed under the influence of the compressed dressings, and as the tension of the skin

Fig. 7.—Patient at time of discharge from hospital.

was much less, in consequence, on June 5, I terminated the series of my operations by removing from each side, in the old scars, two small fragments which further diminished the volume of the nose. A month later the patient was thoroughly cured and was able to return home. At that time the scars on the nose, cheek and lip were scarcely apparent, and there no longer remained any spots of nevus. The flap was slightly paler than the surrounding skin; however, experience has demonstrated that the difference of color becomes considerably attenuated with the passing of time. The nose, which was somewhat aquiline and regular in form, was much smaller than before the operation. There was no eversion of the lower eyelids, nor was there any displacement of the inner canthi, and the mouth was absolutely symmetrical. When the patient departed, she had the appearance seen in Figures 6 and 7, taken on July 6, 1922.

COMMENT

If I make a rapid survey of the different methods of operation used in removing a nevus from the face, I come to the conclusion that before proceeding to the transplantation of a flap, it is to be recommended, first, that the lesion be reduced to the utmost possible extent by repeated excisions of the cutaneous areas. When the power of expansion of the skin has reached its extreme limit without producing traction of the eyelids, the eyebrows, the alae of the nose and the lobes of the ears, we may think of grafting. The advantage which the dermo-epidermic grafting presents over the Thiersch grafting is that in the first case the transplanted tissues remain much more supple than in the second. However, the operator must make his choice according to each particular case.

Certain authors seem to confound the Thiersch grafting with the dermo-epidermic grafting, which is also called the total cutaneous grafting. In reality, there exists a fairly considerable difference between the two, since in the first variety one intervenes only on the epiderm and on a very feeble part of the derm, while in the second case one removes the whole thickness of the skin to the subjacent tissue. On the contrary, the massive cutaneous graftings, which are now hardly ever employed, comprise not only the skin, but also a certain quantity of adipose substance.

As experience has proved that the dermo-epidermic grafting retracts with time, I am of the opinion that it is better to cut the graft one-third or one-fourth larger than the substance that has to be replaced, especially when it has to be applied near the eyelids and the orifices of the face, than to follow Dubreuilh's recommendation to take off a flap smaller than the wound to be repaired. In fact, if it is found that this graft is slightly too large, there will always be time later to diminish its size; it is much more practical than to add to, if it is considered too small. I would naturally say the same concerning the rhinoplasty.

In the case of this patient, it never was a question of having recourse to the Indian grafting, for it is necessary to avoid making facial scars on healthy tissue. Even with the process of Snydacker of Chicago, which consists in taking a pedunculated flap from the neck, we would with great difficulty have succeeded in making good the entire loss of substance resulting from the excision of the nevus of the cheek and lip.

As to the rhinoplasty, we have also to save the skin of the face, and the Italian method was the only one that could be employed in the present case. Electrical treatment under any form was not to be recommended. Radium might probably have destroyed the nevus of the cheek and lip; however, in the presence of the lesion of the nose, its action would have been ineffective on account of the considerable hypertrophy of that appendage. Moreover, it is a method of which

we are doubtful, since Morestin, at a meeting of La Société de Chirurgie de Paris, on June 16, 1915, reported his observations in the case of a man suffering from a vast pigmented hairy and warty nevus of the face, which he cured surgically. His patient, he declared, "had been treated for a long time by sparks of high frequency without any result. He had also been submitted to a prolonged treatment by radium without having obtained the least amelioration."

CONCLUSIONS

The problematic effect of a cure of pigmented nevi of the face by physical agents being granted, I believe that the most rational treatment of this deformity consists first of all in making repeated extirpations of fragments of the skin.

When the integuments have attained the maximum of their extension without producing traction on the surrounding parts, it is necessary to have recourse to grafting by giving preference to the dermo-epidermic graft. There is no need for me to insist on saying that the operation should be made in an aseptic manner, and that the wound in the face should be rendered bloodless before transplanting the flap.

The fact of suturing the latter diminishes the dangers of displacement, regularizes the coaptation and facilitates success.

The paraffined dressings render great service, especially for the Thiersch graft.

Finally, the Italian method is the one which gives the best results in the case of total rhinoplasty.

TUMOR OF RIGHT INTERNAL AUDITORY MEATUS

WITH INVOLVEMENT OF THE GASSERIAN GANGLION AND PONS

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CASE REPORT

History.—Mrs. A. D., a widow, aged 45, consulted Dr. Peter Bassoe, Aug. 24, 1922, complaining of a severe pain on the right side of the face. The patient being unable to speak English, it was learned through an interpreter that several years previously she had come from Armenia to the United States. While in Asia, she had been well except for an attack of paralysis, accompanied by the inability to speak. Full recovery occurred before coming to America. During deportation from Armenia the patient had lost seven of her children and had suffered much mental agony on this account. Because of the negative physical findings and the previous history, a diagnosis of depressed mentality was made.

In February, 1923, the patient again consulted Dr. Bassoe. The severe pains on the right side of the face had persisted. Dr. Bassoe could find no organic disease and believed the condition was definitely functional. The patient appeared more depressed than on the previous examination.

Hospital Record.—On April 20, 1923, the patient was brought to the Presbyterian Hospital in a stuporous condition. The history obtained from a brother was that the patient had been suffering from a severe pain, situated just to the right, and behind the right eye.

In April, 1922, a number of teeth had been extracted in the hope of relieving the pain. However, no improvement occurred. During the last year the patient had been at the Cook County Hospital for two months. Roentgenograms of the skull had proved negative, and treatment of the right maxillary sinus had given no relief. The condition appeared to be gradually getting worse.

During the last year the patient had had occasional vomiting spells and once or twice had fallen on getting out of bed. Vision was disturbed, and although glasses were fitted there was no improvement. For the last six weeks the patient had seen double. During the last few weeks there had been almost continuous vomiting. Incontinence of urine and feces had been noted for ten days and drowsiness for the last four weeks. Just lately the neck had appeared stiff. No disturbance of hearing had been noted at any time.

On examination, on April 20, the patient was seen to be in a stuporous condition. The neck was rigid and there was a partial paralysis of the left side of the face. The knee-jerks were positive. The patient became comatose during the evening.

Examination of the eyes by Dr. Wilder revealed a considerably swollen optic disk on the right side of at least 3 diopters, the physiologic cup being almost obliterated. No hemorrhages were seen, but the retinal veins were engorged. The diagnosis of papilledema was made.

On April 21, a spinal puncture by Dr. Bassoe revealed the fluid clear and the pressure 60 mm. of mercury. The cell count was 37, and the spinal fluid Wassermann was negative. A roentgenogram of the skull proved negative. The urine showed no pathologic findings. Examination of the blood revealed, the red blood corpuscles, 5,280,000, and the white blood cells 28,000. The blood pressure was 120 systolic, and 86 diastolic. The temperature varied from 101 to 104 F. (per rectum).

On April 22, the patient's condition gradually became worse, and death occurred at 10:30 p. m. A clinical diagnosis of brain tumor (right cerebral hemisphere) was made.

Necropsy was performed on April 23 by Dr. H. A. Oberhelman. Only that part of the examination pertaining to the tumor and cause of death is given.

Necropsy Report.—"The cerebral spinal fluid is a little cloudy and contains small gray flocculent masses. Marked edema of the brain is seen.

"The dura covering the right gasserian ganglion is raised because of a tumor in this region. This extends through the foramen ovale following the course of the right mandibular nerve, and down into the soft tissues practically to the inner surface of the right mandible where this nerve enters the bone.

"The tumor extends back on to the front surface of the right petrous bone, and this surface of the bone appears somewhat motheaten by erosion of the tumor. The tumor extends back against the cerebellum and also somewhat toward the pons. The right major wing of the sphenoid bone, close to the sella

Fig. 1.—Coronal section through the cochlea, showing the tumor mass (T) in the internal auditory meatus, along the side of the cochlear nerve (× 6).

turcica is also somewhat eroded by the tumor. The foramen ovale is enlarged so that it has a diameter of 8 mm. The right gasserian ganglion cannot be identified and is apparently involved in the tumor growth.

"The tumor itself is soft, gray-red and most of it is outside of the dura. The entire mass, after the brain is removed, is from 3 to 4 cm. long and 2 cm. in diameter. There is no evident pressure of the optic chiasma or pressure deformity of the pons.

"The lining of both middle ear cavities as well as of the ethmoid, sphenoid and frontal sinuses is without gross change. No gross change is noticed in the nasopharynx.

"Anatomic Diagnosis: Tumor of the right gasserian ganglion (?) with extension through the foramen ovale, tumor erosion of the right wing of the sphenoid, and inner end of the petrous bone; and marked edema of the brain."

The right temporal bone was given to me for sectioning. Unfortunately, no mention of the pathology of the case was made at the time, so that it was not until a number of sections had been lost that the presence of the tumor in the internal auditory meatus was discovered. This led to an investigation as to the necropsy record and an explanation of the microscopic findings.

The temporal bone was first sectioned coronally, in order to cut through the cochlea. Following this, the bone was reblocked and horizontal sections from above down were made. The sections were stained with hematoxylin and eosin, and Mallory stains.

Microscopic Sections: The coronal sections showed tumor mass extending into the internal auditory meatus, beside the cochlear nerve, but not invading it (Fig. 1). In part, the tumor seemed to be encapsulated. None of the sections

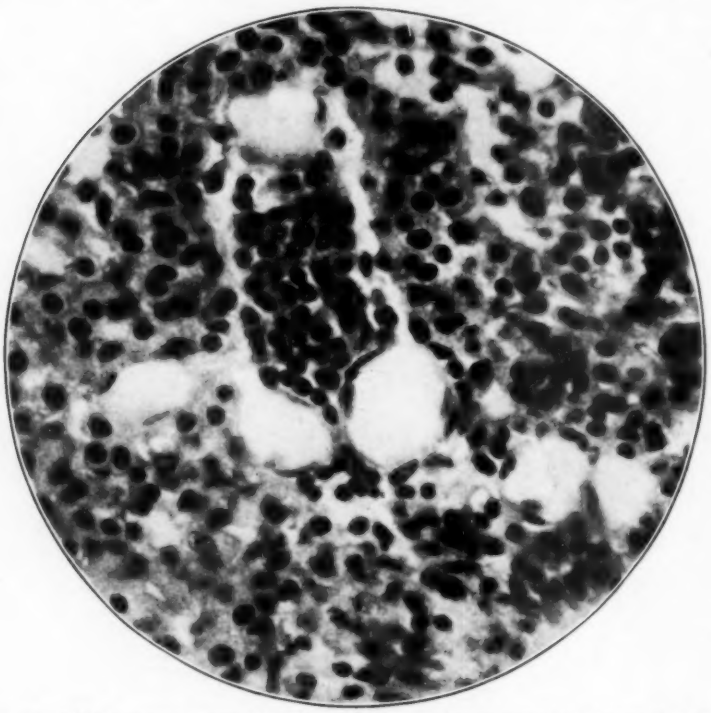

Fig. 2.—High power magnification of tumor tissue seen in Figure 1 (× 560).

showed any invasion of the nerve or the cochlea itself. The changes seen in the organ of Corti appeared to be from error in technic, or from necropsy rather than pathologic.

The horizontal sections showed that the tumor had invaded the vestibular nerve, and areas of tumor cells could be seen in the nerve tissue. The tumor infiltration was quite considerable and extended almost to the region of the macula acustica and crista ampullaris. The change seen in these areas could not definitely be ascribed to the tumor. The facial nerve, as it passes posteriorly along the medial wall of the typanum did not seem to be involved.

The tumor itself was vascular, and contained many thin-walled capillaries. The tissue was mainly cellular, very little supporting tissue being seen (Fig. 2). Some of the cells contained a fairly large amount of cytoplasm, which appeared to be vesicular in some instances. Other cells contained only a slight amount of cytoplasm. Two main types of nuclei were seen: (1) Large vesicular, and (2)

small hyperchromatic. In some of the cells the nucleus was definitely eccentrically located. Mitotic figures were found only occasionally. The tumor cells appeared to have invaded the walls of the capillaries in places.

In order to study the tumor further, I obtained the brain. It was found that it had been sectioned, and that all of the pons and medulla oblongata were removed excepting a small portion of the former. However, in the right half of this, in the basal portion, there appeared an area of tumor tissue, circumscribed and not involving the periphery. Microscopic sections of this stained with hematoxylin and eosin showed a tumor consisting of numerous congested and partly infiltrated blood vessels, scattered among islands of cell bodies (Fig. 3). The majority of the latter contained nuclei rich in chromatin, with a scanty amount of cytoplasm in some instances, and considerably more in others. Some of the cells were distinctly reticular, resembling the so-called gitter or fat granule

Fig. 3.—Tumor mass found in pons (× 10).

cells. The latter often form small foci and at the periphery of the tumor are mixed with phagocytic bodies (myelophages). Unfortunately, the record of the original sectioning of the brain and its examination has been lost.

COMMENT

In view of the involvement of the eighth nerve and gasserian ganglion in this case, tumors of these structures must be considered. Tumors involving the eighth nerve have been well described by Cushing.[1] It is evident from this author's description that these tumors

1. Cushing, H. C.: Tumors of the Nervous Acusticus, Philadelphia, W. B. Saunders Company, 1917.

arise along the peripheral portion of the acoustic nerve. Extension occurs by spread of the tumor inward through the nerve, until finally the adjoining structures in the cerebellopontile angle suffer from secondary compression effects. Consequently the symptoms, first, are those of eighth nerve involvement, namely, deafness, tinnitus and vertigo; and later those of irritation of other cranial nerves, particularly the fifth and sixth. Pathologically, the acoustic tumor does not seem to grow into adjacent nerve structures, nor to metastasize. Histologically, it is a neurofibroma.

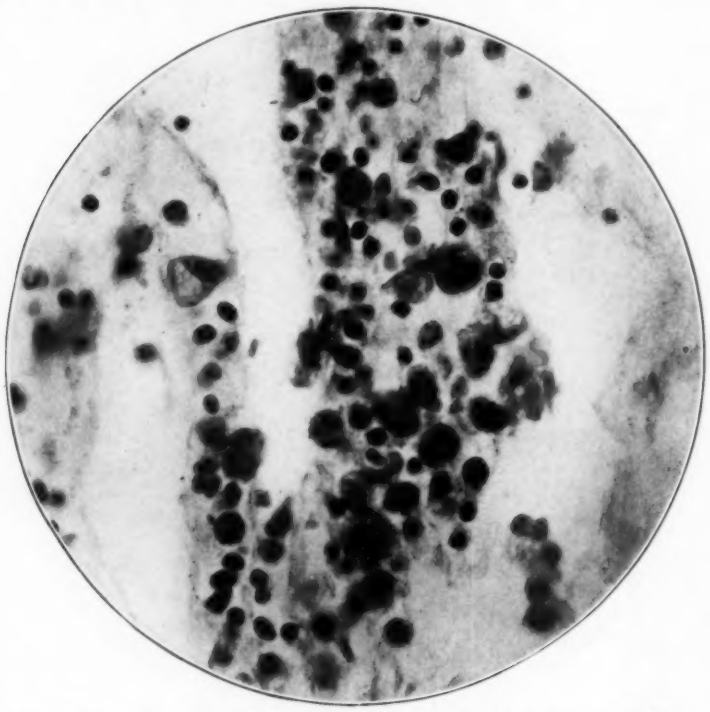

Fig. 4.—Abnormal cells found in subarachnoid space (× 560).

In the recent literature there have been two reports on tumors of the gasserian ganglion. Russell [2] reports on two cases. Each patient was operated on and the postoperative recovery of both was uneventful. However, clinical experience shows that these symptoms frequently recur and that operation is usually palliative. Rand [3] submits a report of a patient on whom operation was also performed, recovery occurring promptly. The literature is thoroughly reviewed and the diagnosis of

2. Russell, Ethel C.: Two Primary Tumors of the Gasserian Ganglion, J. A. M. A. **84**:413 (Feb. 7) 1925.

3. Rand, C. W.: Tumor of Left Gasserian Ganglion, Surg., Gynec. & Obst. **40**:49 (Jan.) 1925.

these tumors is discussed in detail. The symptomatology shows that in these cases the third, fourth, sixth and eighth nerves are often involved.

The origin and pathology of gasserian gangion tumors is not definite. They have been described as endothelioma, perithelioma, sarcoma, carcinoma, glioma, gumma, fibroma, aneurysm, adamantoma, osteochondroma and neurocyst. On the whole, the opinion is that the majority of the tumors are endotheliomas.

The pathology of the tumor in the case here reported is apparently most closely allied to that of a round-celled sarcoma. The tumor is made up mainly of cells which are fairly uniform in appearance and which tend to invade the walls of the blood capillaries.

As to the site of origin of the tumor there are two possibilities: (1) that it originated in the pons, and secondarily invaded the gasserian ganglion and internal auditory meatus, extending via the perivascular channels of Virchow-Robin to the subarachnoid space, and from here to the perineural sheaths of the fifth and eighth nerves; or (2) that it originated extracerebrally and involved the brain secondarily, either by extension or by metastases along the blood vessels.

The first possibility would seem the more likely in view of the recent work of Hassin.[4] This author finds experimental and histopathologic evidence that supports the view that the probable flow of cerebrospinal fluid is away from the brain tissues, toward the ventricles and toward the subarachnoid space, by way of the spaces of Virchow-Robin. Hence tumor tissue, such as in a tumor of the pons, can easily be carried to the subarachnoid space and from here outward along the perineural sheaths.

To determine the possible correctness of this view, sections were made of various portions of the brain and in such a way as to include the subarachnoid space. On examination, all of the sections showed many abnormal cells in the subarachnoid space which resembled the tumor cells as seen in the pons and internal ear. A typical area is shown in Figure 4. From these findings it would seem most logical to conclude that the tumor originated in the pons and spread in the manner first mentioned.

It is of interest that in the internal auditory meatus, the tumor invaded the vestibular portion of the eighth nerve, while extending along the side of the cochlear division and appearing almost encapsulated in this region.

CONCLUSION

From the history of the patient there was no disturbance of hearing. The examination of the spiral ganglion cells and the organ of Corti did

4. Hassin, G. B.: Notes on the Nature and Origin of the Cerebrospinal Fluid, J. Nerv. & Ment. Dis. **59** (Feb.) 1924.

not offer evidence that the tumor had been causing pressure on the cochlear nerve. As to the vestibular division, the history shows that the patient fell several times on getting out of bed. The occasional vomiting spells may or may not have been of vestibular origin. The continuous vomiting just prior to death was evidently due to increased intracranial pressure. From the microscopic picture it would seem that the vestibular nerve had been so extensively involved that its function must have been either diminished or destroyed. The lack of vestibular symptoms of the patient may be accounted for by the fact that the tumor invasion was probably very slow in its progression.

The probable cause of death was, no doubt, the edema of the brain.

Clinical Notes

A NEW PROCEDURE FOR THE POSTOPERATIVE CARE OF LARYNGOSTOMY*

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In presenting my method, I make no special claim for priority, as some such procedure may have been advocated previously without my knowledge. However, so far I have been able to discover, this mode of treatment overcomes one of the most trying obstacles to the successful management of this condition and does so without danger or discomfort to the patient. I have found no previous mention of a similar method in the literature.

The object of the device presented is to prevent contraction of the laryngostomy wound and to maintain a good exposure over a long period of time, as long a period as may be necessary for the proper dilatation of the stenosis.

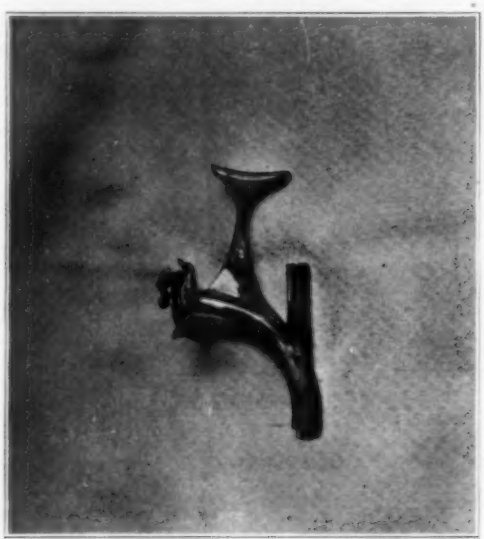

Fig. 1.—Tucker laryngostomy tube, with post attached.

This it does in a very simple manner, without requiring the use of any packing in the wound following operation, and without pain or discomfort during the period of healing.

The device consists of the addition of a post to the ordinary laryngostomy tube or, preferably, to the Tucker tube, which is the one used in Figure 1. This post is calculated to fit the laryngostomy incision snugly, and is so designed that the upper end, or saddle, extends from the rubber tube inside the larynx to the skin, this saddle being wide enough to give the necessary "spread" to the upper end of the incision. The tube itself does the same for the lower

* Read at the meeting of the American Academy of Ophthalmology and Otolaryngology, Chicago, Oct. 22-24, 1925.

Fig. 2.—Showing apparatus in place.

Fig. 3.—A typical laryngostomy incision, after wearing apparatus for six months.

end, leaving the edges free between these points. Thus, the epithelium grows in and rapidly covers the raw edges of the wound without the necessity, in most instances, of drawing the skin and mucosa together.

The laryngostomy is done in the ordinary manner and the tube is inserted immediately. No packing is used except the ordinary dressing externally, and this is changed as often as is necessitated by the secretions. Should the raw surfaces show a tendency to too free bleeding during the first twenty-four hours, a light gauze pack may be introduced along the sides of the post for its control. This will not usually be found necessary, as a well fitting rubber dilating tube will prevent much leakage into the trachea, even though surface bleeding may be considerable.

Subsequent dressings consist in the simple changing of the tube, which causes little discomfort. The skin edges are sensitive for a week or two, but this

Fig. 4.—Showing the extent of the exposure.

quickly subsides as healing progresses. Healing is rapid and with a minimum of granulation, although there is some thickening and growth of granulation tissue at the upper end of the post around the saddle.

The post takes the place of the wire which, on the Tucker tube, is for the purpose of tying the thread for anchorage of the dilating tube. I secure excellent anchorage by bringing the thread around the tracheotomy tube, tying it on top where the knot is out of the way and cannot irritate the skin.

The presence of the post does not materially increase the difficulty of slipping the dilating tube down over the "up and down" portion of the apparatus when it is in place. In fact, the excellent exposure obtained in this way and maintained by the continued use of the apparatus makes the changing of tubes and dressing of the wound a quick and simple procedure. The patients quickly become accustomed to the presence of the post and do not object to it in the least.

264 Metropolitan Building.

TIC DOLOUREUX AND TRIGEMINAL NEURALGIA

Relieved by Treatment of the Nasal (Sphenopalatine) Ganglion *

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In the February, 1925, issue of the *Laryngoscope* I reported a classical case of tic douloureux, which was relieved by injection of the nasal ganglion through the palatomaxillary canal route, which treatment I advocate. Since that time, I have found this method of injection successful also for trigeminal neuralgia.

The palatomaxillary canal route which I have described, has the great advantage of reaching not only the nasal ganglion, but also the maxillary division of the trigeminal nerve. Tic douloureux appears to be an involvement of both the sensory trigeminal fifth nerve and the motor facial seventh nerve. Not only is there pain along the mandibular, maxillary and ophthalmic branches of the trigeminal, but also synchronous with the pain there is a spasm of the face muscles innervated by the seventh nerve. An impulse giving such a double stimulus would necessarily have to strike both nerve systems at a common junction. This center is apparently the nasal ganglion which receives the sphenopalatine nerves from the maxillary division of the trigeminal nerve, and the greater superficial petrosal from the facial nerve. In addition to this anatomic reason for the probable origin of tic douloureux at the nasal ganglion, we have a good pathologic probability. Of all the nerve centers in the head, the nasal ganglion lies most exposed to disease processes. In its position between the ethmoid, sphenoid and maxillary sinuses, it lies in an area frequently exposed to suppurative processes and the absorption of toxic products. Here we have a center connecting both the trigeminal and facial nerve systems exposed to congestion from every nasal cold. So superficial does the nasal ganglion lie, that it can be affected by the superficial application of silver nitrate or cocain to the mucous membrane under the tip of the middle turbinate. It was reasoning along this line that led me to attempt the injection of the nasal ganglion and maxillary nerve for tic douloureux, with complete success.

For this purpose the injection of the ganglion by way of the palatomaxillary (posterior palatine) canal, which I have described in previous publications, has the great advantage over the nasal route, as at the same time one injects the maxillary division of the trigeminal nerve, which is probably the most frequently affected of the trigeminal branches.

There is no doubt that tic douloureux in many cases starts from an irritation of dental origin; an additional frequent source is probably the nasal ganglion.

REPORT OF CASES

CASE 1.—*History.*—Mrs. L., aged 64, referred to me by Dr. N. Gordon, had a classical case of tic douloureux. For four months prior to coming under our observation, she had suffered from severe spasms of tic douloureux. So great was her agony that, in spite of the continuous use of large doses of morphin, she was unable to speak or eat without getting a spasmodic contraction of the muscles of the right side of the face, associated with knife like cutting and burning pain. The slightest draught of air would induce an agonizing attack. For two weeks she was under observation in a neurologic

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* From the Nose and Throat Department of the New York Post Graduate Medical School, and from the Hospital service of Dr. C. J. Imperatori.

institute, where it was decided to perform a resection of the gasserian ganglion. When the possible incidental complications were explained to her, she refused operation. I saw her subsequently, and recommended injection of the nasal ganglion and maxillary nerve by the palatomaxillary route. This injection, which can be done in a few minutes, was followed by immediate and complete relief. It is now one year since I performed the injection and there has not been the slightest recurrence. This patient was presented at the New York Clinical Society Meeting at the home of Dr. Kleinberg.

The nose and throat examination revealed a moderate atrophic rhinitis, slight clouding of the right antrum, probably from a thickened membrane, and chronic tonsillitis.

The three other cases referred to here are rather of the type of trigeminal neuralgia associated with contraction of the buccal musculature during the attacks, but not of the spasmodic type characteristic of tic douloureux.

CASE 2.—*History.*—Mrs. R. L., aged 62, one and a half years ago, came to me complaining that for three years she had been suffering from pain on the whole right side of the face associated with twitching during the attacks. The pains, which were severe and drawing in character, began either around the eye or ear and spread to the entire face. The pains were induced by talking or eating and forced the patient to live on fluid or mushy foods. She received an alcohol injection of the nasal ganglion by the palatomaxillary route, with immediate and complete relief. This relief lasted till six months ago, when when she received two injections; the first was unsuccessful because the needle had apparently perforated the soft palate instead of entering the canal. Reinjection was performed one week later with complete relief. Subsequent to the second injection, the patient developed a feeling of numbness in the area of distribution of the maxillary nerve. This numbness, however, is hardly to be compared with her previous complaint of pain. One week ago she began complaining of a slight haziness of vision in her right eye, but the sight is apparently as good as that of the left eye. She also says that the right cheek at times flushes with a brighter red than the left. The right side of the nose also feels dryer than the left.

Nasal examination revealed a bilateral posterior ethmoiditis and chronic tonsillitis.

The next case is one of trigeminal neuralgia also not the classical tic douloureux, but associated with a steady contraction of the cheek muscles during the flash of the sharp, knife like pains.

CASE 3.—*History.*—Mr. S. R., aged 50, was referred to me by Dr. Fred Glucksman. The patient complained of sharp, knife like pains coming in a flash, sticking the chin, cheek and forehead of the left side and spreading to the temporal region. The complaint was of six years duration. Four years prior to examination, he received injection of the maxillary and mandibular nerves by a dentist; this gave relief for seven months, when he again received a number of injections with no relief. At the time he came for examination he was unable to eat or sleep because of the pain. Prior to his coming to see us, the attacks had become so severe that he was unable to eat anything but mushy foods and had to speak quite slowly to avoid inducing any attacks.

Examination revealed a deflected septum impacting against the posterior portion of the middle turbinate, and chronic tonsillitis with a history of repeated peritonsillar abscesses on the left side.

I performed a tonsillectomy, simultaneously injecting the nasal ganglion with alcohol by the palatomaxillary canal. This yielded a moderate amount of relief. The patient subsequently received three alcohol injections of the ganglion, with considerable although not complete relief. He is now able to eat and sleep comfortably. Apparently, some irritation of the mandibular nerve still remains, which can be aroused by the patient touching the mandible with his tongue.

One case showed simple involvement of both the trigeminal and sensory root of the facial nerve, evidently traveling through the nasal ganglion.

CASE 4.—*History.*—Mrs. M. H., aged 45, complained of pain in the left maxillary region radiating to the mastoid and occipital region. The complaint, which was of fifteen years' duration, began on the right side but at the time of examination was present only on the left side. The attacks occurred every week, lasting for two or three days, associated at times with nausea or vomiting. She also suffered from rheumatic pains in her ankles and sacral region.

Examination revealed no pathologic changes other than chronic tonsillitis.

I performed a tonsillectomy simultaneously with injection of the nasal ganglion, which procedure also produced more than half the anesthesia necessary for the operation.

For twenty days subsequent to the tonsillectomy and injection, the patient was entirely free from the pain. During the following fourteen days she had two attacks, and since then she has been practically free from the neuralgia.

COMMENT

In the treatment of nasal ganglion neuralgias, it has been my practice not only to perform the alcohol injection, but also whenever possible, to eradicate the probable source of the irritation at the same time. In patients in whom a deflected septum impacting on the middle meatus, chronic ethmoiditis or sphenoiditis or chronic tonsillitis are etiologic factors, the diseased area is operated on at the same time that the injection is given.

Alcohol injection is necessarily a temporary affair if the diseased area causing the neuralgia is permitted to remain. In the case of Mrs. M. H., the only probable scource was the chronic tonsillitis

Although one injection usually produces a marked improvement, and in some cases complete relief, most patients require two or three injections.

351 West Eighty-Sixth Street.

PROGRESS IN OTOLARYNGOLOGY

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

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PRESENT STATUS OF OUR KNOWLEDGE OF ALLERGY IN ITS RELATIONSHIP TO OTOLARYNGOLOGY

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(Continued from page 498)

PHYSICAL ALLERGY

In the previous paragraphs, several varieties of altered reaction have been described, each caused by sensitiveness to material substances. In the subsequent paragraphs, I will describe altered reaction quite similar in character to the foregoing which is not caused by sensitiveness to material substances, but by specific hypersensitiveness to the action of physical agents, such as light, heat, cold and mechanical irritation. In allergy of this type, we find several different varieties of reaction.

The effect on hive, hay-fever and asthma cases of changes in temperature and moisture in the air, "changes in barometric pressure," heat, exercise, emotional disturbances and reflexes has been noticed and mentioned to me by many patients. The effect of these agencies has been repeatedly mentioned in medical literature. This action, however, has been looked on as a matter of secondary importance, and has been believed to be an inciting cause of reaction due primarily to some other fundamental process. In cases in which an illness has been directly attributed to the action of physical agents, no effort has been made to prove it to be allergic in origin. It is interesting in this connection to quote Bostock, who in 1819 described his own case of summer hay-fever under the term "catarrhus aestivus." He believed that the cause of his illness was heat and the sun's rays, and stated, "By using every means of obtaining fresh air without much exertion, and by carefully avoiding a moist and close atmosphere, the symptoms may in some measure be kept off." He stated also, "During the last summer the patient was so situated as to be able to avoid almost every degree of bodily exertion; he remained nearly confined to the house for about six weeks, and the result was that, notwithstanding the unusual warmth of the season, he experienced much less of the affection than he had done for several years before." It is interesting to repeat that "He was relieved

by using every means of obtaining fresh air," a procedure which makes pollen cases worse, but which relieves heat sensitive cases such as I shall describe subsequently.

For more than one and a half years, not only have I tested patients presenting symptoms such as hay-fever, asthma, urticaria, angioneurotic edema and eczema for specific sensitiveness to material substances, such as pollen, epithelium and food, including intracutaneous tests with some 300 foreign substances, but also I have tested them systematically with physical agents, such as ice applied to the skin generally and locally, cold baths, refrigerated air at 37 F. and at 20 F., hot applications, hot baths, dry heated air, moist heated air, and heat applied through the use of an autocondensation current, sunlight and actinic ray, physical exercise and changes in air pressure. These tests were carried out both on patients sensitive to pollen and on patients who were apparently insensitive to material substances.

Through this study I have been forced to look on allergy from a totally different point of view than formerly, and I believe now that many of the so-called "nonsensitive cases" must be classed as a new type of allergy; namely, physical allergy; and that in allergy of this type there are several different varieties of reaction.

To summarize the subject briefly, it may be said that patients with physical allergy fall grossly into one of two classes; namely, those in which the reaction is confined to the area directly exposed to a physical agent and the others in which reaction may involve not only areas directly exposed but distant structures as well. In the latter type, the reaction may appear solely in distant structures. In this case, the source of the trouble may seem obscure.

The most interesting of the contact cases are those sensitive to light, cold and mechanical irritants. Patients sensitive to one of these agents are rarely sensitive to the others. Since the skin is most easily exposed to these agents, it is usually the skin which reacts most markedly. For example, if a patient is sensitive to the action of light and the skin is exposed to light, an eruption will appear usually in a short time, characterized by redness, edema and itching of the skin. If the subject is not excessively sensitive, a longer exposure is required to produce a reaction, but in this case it remains longer and may, after a period of hours, resemble eczema rather than an urticarial rash. If the conjunctivae or mucous membrane of the mouth are exposed, a similar reaction may appear, and if the retina is exposed, pain or temporary blindness may follow.

In patients sensitive to cold, the reaction is exactly the same except in the fact that instead of being brought out by light, it appears only after exposure to cold. It appears usually after exposure to certain

degrees of cold; namely, best between 5 and 20 C. If the skin is exposed, the reaction is one of urticaria. If the eyes are exposed to a cold wind, the reaction resembles that which occurs in sensitive patients after exposure to pollen. If cold air is breathed deeply, typical nasal allergy or bronchial asthma may follow, and in case the patient drinks a glass of cold water, nausea, vomiting and abdominal pain may ensue.

The reaction in patients sensitive to mechanical irritation is exactly the same except for the fact that the eruption follows mechanical irritation instead of exposure to either light or cold. This type of reaction, however, is not of great interest to otolaryngologists, since the mucous membranes are rarely involved.

As previously mentioned, if the patient is highly sensitive, the reaction appears after slight exposure in acute form. If the patient is slightly sensitive, a more severe exposure is required to produce the reaction, and a more chronic type of disease will follow.

It seems proper so far as the skin is concerned that contact reactions as before described be termed "factitious urticaria," whether the reaction is caused by light, heat, cold or mechanical irritation. Under subheads can be included the type caused by light (urticaria solaris), the type caused by cold (urticaria hiemalis) and the type caused by mechanical irritation (urticaria dermographica). In case of delayed reaction, however, when more intense exposures lead to a dermatitis, the term dermatitis should be substituted for the term "urticaria." Since cases of these varieties have been described in detail in a previous paper, it seems unnecessary to repeat them here.

Several suggestions were made in a previous communication concerning the possible pathogenesis of reactions of this type. Two may be worthy of repetition. In one it was assumed that the patients, coming as they do from allergic families, may have been specifically hypersensitive to some new body formed in their tissues solely under the influence of one specific physical agent, and that they may react to this body just as patients sensitive to pollen react on contact with pollen.

A second possible explanation was: We may presume that in the body we have chemical bodies which are capable of being transformed under the specific influence of certain physical agents, to give rise to the nerve impulse, which is recognized by the brain as having been caused by that agent. In the terminals of the optic nerve, for example, there must exist bodies which can be transformed under the influence of light, to give rise to the impulse in the optic nerve, which is recognized by the brain as having been caused by the action of light. Similarly, we must have bodies at other sensory nerve terminals which are transformed by the action of cold, heat or friction, to give rise to their respective nerve impulses. These substances under normal conditions must be confined

or nearly confined to certain nerve terminals. It is not beyond the realm of fancy to believe that, under pathologic conditions, one or more of these chemical bodies escapes from the terminals in which it is normally confined and diffuses through the body, thereby rendering such tissues as absorb it sensitive to a physical agent. For example, if photo sensitive bodies in the retina should be distributed by the blood and absorbed in the skin, the skin should become sensitive to light. This would seem analogous to the fact that bile, which is ordinarily confined to the biliary and intestinal tract, under pathologic conditions is absorbed and distributed by the blood, and stains the tissues generally; and to the fact that pigment, which is normally confined to certain cells, escapes from its ordinary areas of confinement under certain conditions, such as melanosarcoma, and lodges in many of the tissues and secretions. It is not unreasonable to suppose that the light sensitive substances in the retina could under certain circumstances do likewise, and that heat, cold and friction sensitive bodies could do the same. It is admitted that this theory, to be consistent, must depend also on the affected person being one of allergic strain. Otherwise, the reaction should be inflammatory in nature rather than edematous.

Whereas the contact reactions just described are interesting and important, the reflex-like reactions are much more common and give rise to a more varied clinical picture. As previously mentioned, "reflex-like reactions" is the term used in describing reactions which are not confined to the areas directly exposed to the irritating agent, but which involve distant structures as well.

Reflex-like reactions, except for one type involving the nose, caused by exposure of the retina to light, were all caused, so far as my studies have gone, by the effect of heat or cold, or by the combined action of the two. Heat sensitive cases frequently react only after previous exposure to cold and, vice versa, cold sensitive cases react only after previous exposure to heat. These types are not separated from the others because of the fact that in most cases a change in temperature seems to be the controlling factor rather than a temperature of a constant specific grade. However, some patients react to cold of a specific grade or heat of a specific grade. Because of the conditions mentioned, histories are frequently misleading. Heat sensitive cases, for example, which react only after exposure to cold, have reaction chiefly in winter, and the patients always believe it is caused by cold. Vice versa, cold sensitive cases which react best after previous exposure to heat have their symptoms in the summer, and the patients state emphatically that they are caused by heat. For example, a patient sensitive to cold gave a history of having symptoms solely in summer. He stated emphatically that his symptoms were caused by heat. We were unable to reproduce the symptoms by the

application of heat but reproduced them perfectly during a winter month by exposing his body first to heat and following this with ice rub. He then observed that although his symptoms occurred only in hot weather, and especially after exercise, that they appeared only after he began to cool off. He was accustomed to work in the garden in the summer months and after this to fan himself under a certain tree. His symptom asthma would then appear and last sometimes until morning. Through avoiding exercise in hot weather, he has been able to keep himself symptom-free during the hot months for the first time in eight years.

As with contact reactions, so with reflex-like reactions; we may have either an immediate or a delayed reaction. This depends on the degree of sensitiveness of the patient, and the intensity of exposure. In a highly sensitive case, the reaction usually appears quickly and disappears quickly. In a delayed reaction, the symptoms may not appear for a period of minutes or hours, and in this case last much longer. Here the diagnosis may be extremely difficult.

The symptoms which occur as a result of sensitiveness to heat or cold may resemble practically any which are caused by sensitiveness to material substances. When they involve the skin, the reaction, erythema, pruritus and edema, that is, urticaria, may follow, or in the case of delayed reaction, eczema may be the outspoken symptom. When the nasal or bronchial membranes react, the symptoms resemble those of ordinary hay-fever or asthma. The symptoms in highly sensitive cases may be violent and come out under the influence of remarkably little heat or cold. For example, in patients highly sensitive to heat, a skin rash or nasal or bronchial reaction may be brought out by having the patient place his hand for a moment in warm water, by exposing him to a hot lamp, or diathermic or autocondensation current for a few seconds or even by the heat generated by so little exercise as putting on an overcoat, walking up a few steps, turning over in bed quickly, or even by that generated by the mental activity coincident with an argument, the excitement of watching an athletic contest or even an interesting business deal. These small amounts of heat could actually in one case cause complete stoppage of the nose, in another the severest kind of asthma and in another a severe urticarial rash, which would make the patient fairly claw himself to pieces. Reaction in cases which react promptly can be stopped immediately or prevented by the application of cold in any form, such as the removal of clothing, an electric fan, having the patient place his hands in cold water or the drinking of cold water. Illness can frequently be prevented, as in Bostock's case, by having the patient keep quiet when he is warmly clad or when he is in a warm place. It was estimated in one highly sensitive case that the

generation of one calory of heat by exercise was sufficient to bring out reaction if the patient were warmly clad.

Reactions caused by cold are similar to those caused by heat except in the fact that they are relieved by heat or by physical or mental exertion. In several cases of asthma due to cold sensitiveness, the symptom asthma could actually be relieved by physical or mental exertion. In one case a marked attack was actually relieved by a fistic encounter. One could surely count on the fact that this would have made symptoms worse rather than better, if they had been caused by anything other than sensitiveness to cold.

As previously mentioned, in many cases, reactions caused by heat or cold follow change in temperature rather than exposure to a temperature of any certain specific grade, that is, patients sensitive to cold react more markedly, as a rule, if they are previously exposed to heat, and patients sensitive to heat react more markedly if previously exposed to cold. Cases of this variety occasionally gain tolerance through frequent exposure, and for this reason give seasonal histories, that is, a history of attacks occurring during the first warm days of spring or summer or during the first cold days of fall or winter. This, however, is not always the case. In several cases patients sensitive to heat had symptoms most markedly when the thermometer registered 80 F. or more. The manifestations were always made worse during hot weather by physical or mental exercise and by humidity in the atmosphere. Vice versa, patients sensitive to cold occasionally reacted only when the thermometer registered a certain low grade. In this case, symptoms were usually relieved instead of made worse by exertion.

Patients sensitive to heat often run a subnormal temperature and react most markedly when body temperature is lowest. Reaction usually follows a rise in temperature, if it is markedly subnormal, and disappears after the temperature is brought to a normal level through any agent—through heat or the use of a vaccine, or by physical exercise. Reaction occurs with a rise of temperature, but when temperature becomes normal or above, it is thereafter difficult to elicit through the action of heat. Heat sensitiveness of this type, I am sure, accounts for many cases of reaction which occur during the late evening or early morning hours when body temperature, as a rule, is at its lowest ebb, and accounts also for many cases of allergy which are relieved by vaccines and by febrile diseases, such as erysipelas, scarlet fever or even pneumonia.

In one patient subject to chronic urticaria and angioneurotic edema, symptoms disappeared invariably when she left home. On her third visit to me in Kansas City, it was finally learned that her home environment was depressing, and that she was subject to fits of temper when displeased by her husband. A rash would usually appear one or two

hours afterward. It was found that while at home her temperature ran markedly subnormal, and that with displays of temper her temperature would rise and the rash would follow. When she moved to an environment which pleased her, her body temperature would remain relatively normal, and heat, exercise or temper would have little effect on her. It was possible in this case through simple change in environment to completely rid her of her illness.

A theoretic explanation for reaction caused by heat or cold is difficult. One might call it a simple reflex. This would amount to nothing more than placing a cloak of knowledge around uncertainty. An adequate explanation needs to be more detailed than this.

The mechanism involved in reflex-like reactions would seem to be more complex than that involved in contact reactions. In the latter, the tissues chiefly affected are those which are directly exposed to the irritating agent. In the former case, however, the tissues involved may be distributed over a large part of the entire body.

One might advance the same theories in this connection that were used in an endeavor to account for contact reactions, and assume that the action of the physical agents in the contact cases was direct on peripheral tissues or peripheral efferent nerve endings, while in the reflex-like cases that the action was exerted on sensory or afferent nerve terminals. Through the latter, abnormal impulses might be generated and transmitted to the autonomic nerve mechanism, and there give rise to the explosive impulses which would manifest themselves as reaction. This theory is not altogether satisfying.

The underlying condition responsible for reflex-like reaction seems more to be one caused by an injured nerve mechanism. One might go further and say that in heat and cold sensitive cases it seems to be a pathologic reaction of the heat regulating mechanism. It seems truly remarkable that warm blooded animals are able to maintain a constant body temperature under such varying conditions of heat and cold, moisture and dryness of the air and rest and functional activity, as the majority are subjected to. Body temperature is maintained at a constant level through complicated reactions which vary the caliber of the surface vessels and vary the secretion of moisture from the skin, nasal and bronchial mucous membranes. When the heat regulating mechanism is normal, body temperature can be maintained at a remarkably constant level under the most varied external and internal conditions. It seems easily within the realm of good reason that this mechanism at times is injured, and that if injured might react in an abnormal manner, not only in relation to the dilatation or contraction of vessels but also in relation to secretion and the activity of nonstriated muscle in general. If such an abnormal mechanism should exist in a person of allergic strain, it seems

conceivable that this mechanism might give rise to the peculiar manifestations of allergy which we ordinarily term asthma, allergic coryza, urticaria, angioneurotic edema, etc.

In support of such a theory, one might advance the fact that a large proportion of patients who are subject to reflex-like reaction caused by sensitivness to temperature change date the onset of their symptoms from a severe illness, often an infectious disease such as might injure any complicated anatomic mechanism.

The diagnosis of physical allergy is usually simple if patients react promptly. It is sometimes complicated by the fact that patients react to more than one agent and occasionally not only to one or more physical agents but to a material agent as well. This state of affairs is not unlike that which occurs in patients who are sensitive to more than one material agent, such as pollen, foods and smoke. In this case also the diagnosis is more difficult than when the patient is sensitive to one material agent only.

In the case of contact reaction caused by light, cold or mechanical irritation, the diagnosis can usually be made through history and confirmed objectively by exposing the patient locally to cold, light or mechanical irritation. The diagnosis is also simple in the heat or cold sensitive cases which react promptly. The symptoms can usually be brought out in heat sensitive cases by heat, or mental or physical exertion, and can be prevented by cold. Vice versa, in cold sensitive cases, symptoms can be brought out by exposing the skin to cold, and can be prevented by the application of heat or by physical or mental exertion.

The treatment of patients sensitive to physical agents is satisfactory, as a rule, if the patient can carry out directions of the physician in detail. Patients who have contact reactions after exposure of the skin to light or cold can usually be relieved by avoidance of the cause; namely, avoidance of light or cold. Patients sensitive to either agent can sometimes be given relative tolerance and be relieved by exposing the skin to increasing doses of the agent which causes their reaction. Patients sensitive to mechanical irritants can obtain marked relief by frequently scratching the skin, generally with a stiff brush.

Patients who give reflex-like reactions caused by the effect of cold can frequently be given tolerance and be relieved through the effect of cold baths. Patients who have reflex-like reactions caused by heat are the most difficult to relieve. They can be relieved frequently through avoidance of agents that reduce body temperature and through the use of agents that keep body temperature at a higher level. Frequently this can be accomplished through an improvement in general health, by the relief of some debilitating disease or environment; often through the use of vaccines which raise body temperature, or through the use of

remedial agents, such as thyroid extract or insulin, which occasionally may have this effect. Epinephrin and other symptomatic remedies for asthma and nasal allergy have the same effect here as in the reactions caused by material agents.

A complete study of this topic may be found in my monograph "Allergy" (C. V. Mosby Company) in which the condition is discussed in relative completeness.

To those who have perused the paragraphs which precede and who may have compared the present status of our knowledge of allergy with that of a decade ago, I think an expression of surprise should be warranted not only because of the rapid progress which has been made but also because of the many points which have been disclosed which should fascinate any careful student and which should prove of interest and importance in the diagnosis and treatment of disease in almost every line of work.

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TUBERCULOSIS OF THE UPPER RESPIRATORY TRACT

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From a survey of the recent literature on tuberculosis of the upper respiratory tract, it is evident that more attention is being paid to treatment than to any other phase of this condition. We find little about etiology or diagnosis, though Howard Morrow and Hiram E. Miller [1] have written quite a comprehensive article on tuberculosis of the tongue. The authors state that, while tuberculosis of the tongue very seldom occurs, they have seen one case in which no other sign or symptom of tuberculosis was found. Out of a total of 1,444 tuberculosis patients, fourteen presented lesions of the tongue. Most of these patients had advanced pulmonary tuberculosis. These authors are very much opposed to a biopsy for diagnostic purposes. If any cutting is practiced, the whole lesion should be surgically removed, which, they say, is the best method of dealing with these ulcers of the tongue. Simple curettement of the lesion tends to spread it; topical applications of various medicines and the use of the roentgen ray and radium were of no value. The electric cautery, however, seems to have some beneficial effect in patients with extensive ulceration.

It is probably true, as Morrow and Miller say, that the surgical removal of the tuberculous ulcer, provided the incisions are not made through tuberculous tissue, is the surest, cleanest way of healing these subjects. Personally, I have not had as good results with the electric cautery in tongue lesions as in other portions of the throat and pharynx, but have found that fulguration of the whole ulcerated and infiltrated area will often remove the diseased tissue without the risk attending the cutting operation. Fulguration, however, requires a greater length of time for healing, and the soreness for a few days after the application is very marked; for this reason it is probable that small areas which do not yield to the electric cautery are best handled by excision.

Considerable care must be exercised in operations for the removal of tuberculoma of the larynx, as shown by a case reported by Boenninghaus.[2] In his patient Boenninghaus had removed a tuberculoma from the posterior commissure with a double curet, cauterizing the wound with the electric knife. The following day a gradual narrowing of the glottic chink began, which grew worse until the fifth day, when a

1. Morrow, H., and Miller, H. E.: Tuberculosis of the Tongue, J. A. M. A. **83**:1483 (Nov. 8) 1924.

2. Boenninghaus, H.: Deutsch. med. Wchnschr. **50**:339 (March 14) 1924.

tracheotomy had to be performed. There was evident interference with the cricoarytenoid joints, but Boenninghaus felt that the injury was not due so much to the removal of the growth as to the subsequent cauterization. It would seem just as probable, however, that the initial removal of the tuberculoma was too extensive. When the surgical removal of a tuberculous growth in the posterior commissure is done, the cutting should not be carried into distinctly tuberculous tissue, but the proliferated epithelium only should be removed. In spite of this experience of Boenninghaus, and his opinion that the cautery was responsible for the narrowing of the glottic chink, I believe it very important that all surgical removals of tissue in the tuberculous larynx should be followed by a proper application of the electric cautery.

MECHANICS OF ELECTRIC CAUTERY

There is little doubt but that the electric cautery is gaining in popularity as the method par excellence for the treatment of laryngeal tuberculosis, and it might be well, at this time, for us to recall the mechanics of its action. Tuberculous tissue is avascular. The production of an eschar necessitates the formation of a separating zone of granulation tissue. The formation of this zone of granulation tissue brings a new blood supply and hence more nutrition to the tuberculous area, thereby aiding in the process of cicatrization. Therefore, not only does the cautery seal the open wound, preventing secondary infections, but has a distinct curvature value on the underlying structures.

HELIOTHERAPY

A great deal of attention has been paid during the last year to the treatment of laryngeal tuberculosis by heliotherapy. The light rays have been applied generally and locally, the sunrays being used and also the Finsen light. Strandberg [3] has been using the Finsen light for a good many years, and was probably one of the first to treat laryngeal tuberculosis by this method. He uses two sizes of carbon arc lights, one of 20 amperes and another of 75 amperes. The advantage of the larger light is simply that more than one patient can be treated at the same time, as the light does not have to be placed so close to the patient. The entire body is exposed for the first few days for ten or fifteen minutes. This time is slowly increased up to the full time of two and and one-half hours every alternate day. Strandberg, however, does not believe that the light bath should be used to the exclusion of other remedies for laryngeal tuberculosis. He claims about 53 per cent. of cures, though he is still uncertain as to how the Finsen bath acts in such a beneficial way. McCutcheon [4] states that laryngeal patients treated by general sun

3. Strandberg, O.: J. Laryngol. & Otol. **39**:9 (Jan.) 1914.
4. McCutcheon, R. H.: Am. Rev. Tuberc. **11**:85 (April) 1925.

exposure improved noticeably faster than those not treated by heliotherapy. He uses, however, the local application of the sunrays as well as the general treatment. His technic for general treatment is that suggested by Rolliar, namely, the gradual exposure of the body beginning with the feet and ankles, then the legs to knees, then the thighs to hips, hips to lower ribs, until the entire body is finally exposed.

There seems to be some difference of opinion as to the value of general heliotherapy for laryngeal tuberculosis, and, according to Danziger,[5] it is not being employed in the European clinics now as much as formerly. However, Bronfin [6] says that while from his own experience heliotherapy is not yielding very encouraging results in advanced pulmonary tuberculosis and is not free from danger in these cases, the complications of phthisis and especially of laryngeal involvements are invariably favorably influenced.

Local application of light into the larynx does seem to have a distinct beneficial effect in the early lesions. Foster and Chapman,[7] who have had ten years experience with this type of treatment, believe that it should be limited to the early cases, as they have never seen a cure from heliotherapy in advanced cases of the disease, and they state explicitly that it should not be used to the exclusion of other forms of treatment. Their technic consists in reflecting sunlight into the larynx by a mirror made up of an alloy of aluminum and magnesium. This alloy is supposed to absorb considerable heat rays while reflecting the greatest amount of actinic rays. The apparatus consists of a standard which fastens to the back of a chair or stand and has two mirrors, one made of the alloy for reflecting the sunlight, and the other made of glass which enables the patient himself to control the direction of the sunrays. A small laryngoscope made of the aluminum and magnesium alloy is used by the patient to reflect the rays into his larynx. As suggested by F. R. Spencer, one value of this type of treatment is that, after training, the patient can carry out the treatment himself, which self-treatment has the advantages of the so-called occupational therapies.

Danziger [5] says that at Prof. Hajek's clinic in Vienna, the light is thrown into the larynx during suspension laryngoscopy. The experience of the Hajek clinics went to show that only the mild lesions were benefitted by this type of treatment.

Samengo [8] has developed an apparatus which combines a suction tube with the tongue depressor, whereby the saliva can be aspirated as

5. Danziger, E.: M. J. & Rec. **119**:556 (June 4) 1924.

6. Bronfin, I. D.: Colorado Med. **21**:334 (Nov.) 1924.

7. Foster and Chapman: Colorado Med. **22**:93 (March) 1925.

8. Samengo, I.: Semana méd. **2**:841 (Oct. 25) 1923; abstr. J. A. M. A. **82**:167 (Jan. 12) 1924.

fast as it accumulates. He uses a nickel laryngoscope for the reflection of the sunrays.

It is probable that Myers' [9] summary of the value of heliotherapy in tuberculosis is as accurate a statement concerning its efficiency as can be made. He does not believe that heliotherapy is, in itself, sufficient treatment for any case of tuberculosis, but when administered with other therapeutic procedures it is of tremendous value. It acts as a tonic, induces quiet and rest, and its psychic effect on patients is very good. The patients see the skin becoming pigmented, and, having a definite program of treatment, carry on for months continuously, when otherwise they would neglect proper hygiene and rest. However, St. Clair Thomson [10] in his consideration of various types of treatment, that he believes are of positive value in laryngeal tuberculosis, does not mention heliotherapy. He does, however, lay stress on the importance of sanatorium treatment. The three special methods of therapy which he says have a specific local effect are, first, silence; second, whispering, and third, the galvanocautery. Of those patients treated by absolute silence 34 per cent. were cured, while whispering gave only a 14 per cent. cure. On the other hand, the active treatment with the galvanocautery cured 62 per cent.

From my own experience I had come to feel that the roentgen ray was of little value so far as the local lesion of the larynx was concerned, so that the experience of Karl Beck [11] is rather interesting. He is quite optimistic as to the advantages of the roentgen ray in the treatment of laryngeal tuberculosis, though he admits that other types of local therapy should not be omitted while the patients are receiving roentgen-ray treatment. Out of thirteen patients treated with the roengen ray three were made worse, three were improved, and seven were apparently healed.

CHAULMOOGRA OIL

During the last few years, the use of chaulmoogra oil has been receiving more and more favorable mention, though perhaps the general attitude of laryngologists is not so optimistic as the first enthusiastic reports concerning its use would have lead us to hope for. Claude L. Larue [12] mentions the importance of having fresh oil, and also that heat should not be employed to dissolve the oil if it becomes solid from having stood in a chilly place. It should be allowed to stand in a warm room and not put into hot water baths. Larue believes that this medication is the most valued recent addition of remedies for the treatment of

9. Myers, J. A.: Minnesota Med. **8**:362 (June) 1925.
10. Thomson, St. Clair: J. Laryngol. & Otol. **39**:22 (Jan.) 1924.
11. Beck, Karl: München. med. Wchnschr. **70**:454 (Dec. 7) 1923.
12. Larue, C. L.: Ann. Otol., Rhinol. & Laryngol. **34**:122 (March) 1923.

laryngeal tuberculosis, that its use will bring relief to many advanced sufferers and possible cure in the earlier cases, and that it is, in fact, the most efficacious nonsurgical remedy used today. The method employed by Lukens, of using the pure oil instead of the 25 or 50 per cent. dilution, is more likely to be followed by favorable results than when the diluted oil is used. Although it has been stated to the contrary, there is really very little danger of producing any pulmonary irritation even by injecting distinct quantities of the oil into the larynx.

TUBERCULIN INJECTIONS

Spencer [13] has suggested the use of tuberculin injected locally into the laryngeal lesion. Into the point of greatest swelling, his technic is to inject small quantities of old tuberculin, beginning with about 0.1 mg., the dose being gradually increased according to the tolerance manifested. The needle should penetrate deeply so as to avoid a subcutaneous injection, and the intervals between the injections should be from two to six weeks. The injections are contraindicated in advanced disease, either of the lungs or of the larynx, when the temperature is above 100 F., and also when there is marked edema. Spencer admits that his experience has not been extensive enough to pass a final judgment on just how much benefit is to be expected, but believes that the patients on whom he has tried it have showed distinct improvement. Although I personally have not had any experience with a local injection of tuberculin, I cannot see that very much is to be gained by its use, but await, with interest, further reports.

A rather interesting idea in the treatment of laryngeal tuberculosis is furnished by D. Leidi.[14] He says that he was struck by the tendency of rhinoscleroma to produce solid scar tissue, a pathologic phenomenon which is the reverse of the destructive tuberculous process. He had never seen a case of tuberculosis or heard of one in a patient suffering from rhinoscleroma. For these reasons he has developed a method of treating cases of tuberculosis of the larynx by the subcutaneous injections of the bacilli of rhinoscleroma, beginning with injections of 0.5 billion of the killed bacilli, he gradually increases the dose up to 10 billion. He says that, on the whole, he has had fair success. At the present time this method of treatment cannot be recommended, although the idea is quite interesting.

As the relief of the pain of laryngeal tuberculosis is one of the chief objects of treatment, any suggestion is welcome that has this end in view.

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13. Spencer, F. R.: Ann. Otol., Rhinol. & Laryngol. **34**:424 (June) 1925.
14. Leidi, D.: Casop. lek. cesk. **64**:441 (March 21) 1925.

Gundrum [15] reports two cases of advanced tuberculosis of the larynx, in which the pain was entirely relieved in one patient and very considerably lessened in the other by the cocainization of Meckel's ganglion. Because of the comparative ease with which this may be done, it would seem that the cocainization of the ganglion might advisably be tried when other measures fail, although it is probable that only comparatively few cases will show the results that Gundrum obtained.

Stenosis of the larynx following laryngeal tuberculosis is not common, although Dennis [16] reports four cases in detail. He says that stricture of the larynx from tuberculosis may be due to any one of the following: tuberculoma, extensive infiltration, paralysis of the abductors, ankylosis of the cricoarytenoid joint, web formation, and amyloid disease. When there is stenosis he urges an early tracheotomy, as it not only gives relief and comfort to the patient but exerts a favorable influence on the disease itself. When there is web formation necessitating tracheotomy, the tube should be left in for months or perhaps for a year before any attempt is made to remove the stricture. Dennis says that most of these patients will probably need a laryngofissure and removal of the obstructing scar tissue, followed by prolonged dilatation.

Tracheotomy in patients with active pulmonary tuberculosis is not as simple an affair as in those who do not have septic tracheal and bronchial contents. Severe wound infection is most common, and I have seen extensive sloughing of the tissues until the tracheal wound was so wide open that the tube could not be kept in place. However, when there is laryngeal stenosis the trachea must be opened, but only for this reason should the operation ever be performed. The idea that perhaps better rest may be had for the larynx is not enough to warrant the procedure. It is doubtful whether any added rest is really obtained, while the increased stagnation of secretions in the larynx, resulting from the decreased power of expulsion, is a very positive element of harm.

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15. Gundrum, L. K.: Pain from Tuberculous Laryngitis Relieved by Cocainization of the Nasal (Sphenopalatine, Meckel's) Ganglion, J. A. M. A. **83**:998 (Sept. 27) 1924.

16. Dennis, F. L.: Stenosis of the Larynx in Laryngeal Tuberculosis, Arch. Otolaryngol. **1**:587 (June) 1925.

News and Comment

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

At the annual meeting of the American Academy of Ophthalmology and Otolaryngology, held in Chicago, October 20-24, Dr. Edward C. Ellett, Memphis, Tenn., was installed as president, and the following officers were elected: president-elect, Dr. Ross H. Skillern, Philadelphia; vice-presidents, Drs. Austin A. Hayden, Chicago, William C. Finnoff, Denver, and George L. Tobey, Jr., Boston; secretary, Dr. Luther G. Peter, Philadelphia, and treasurer, Dr. Secord H. Large, Cleveland. The next meeting will be at Colorado Springs, September, 1926.

LOCAL SOCIETY MEETINGS

CHICAGO: Chicago Laryngological and Otological Society meets on the first Monday of the month from October to May at the Crystal Room, Great Northern Hotel. Chairman, Dr. E. H. Norcross; Secretary, Dr. A. A. Hayden, 25 East Washington Street.

CLEVELAND: Ophthalmological and Otolaryngological Section of Cleveland Academy of Medicine meets on the fourth Friday of each month at the Winton Hotel. Chairman, Dr. E. W. Garrett; Secretary, Dr. M. Paul Moto, Rose Building.

KANSAS CITY, MO: Kansas City Eye, Ear and Nose Society meets on the evening of the third Thursday of each month from September to May, at the Baltimore Hotel. The afternoons of the third Thursday of November, January and March are given over to clinical work. President, Dr. James May; secretary, Dr. A. E. Eubank.

MILWAUKEE: Milwaukee Oto-Ophthalmic Society meets on the third Tuesday of the month, at the University Club, at 6:30 p. m. President, Dr. John E. Guy; Sec.-Treas., Dr. John J. Brooks, Majestic Building.

NEW YORK: Otological Section of New York Academy of Medicine meets on the second Friday of each month from November to May, at 17 West 43d Street. Dr. James Morisset Smith, Chairman; Dr. J. L. Maybaum, 12 East 86th Street, Secretary. Laryngological and Rhinological Section of New York Academy of Medicine meets on the fourth Friday of the month from November to May, at 17 West 43d Street. Otolaryngological Section of the Kings County Medical Society meets on the second Wednesday of January, March and May, at 1313 Bedford Avenue, Brooklyn. Dr. Harry Meyersberg, Chairman; Dr. Charles Breitman, 210 Brooklyn Avenue, Brooklyn, Secretary.

PHILADELPHIA: Section on Otology and Laryngology of the College of Physicians of Philadelphia meets on the third Wednesday of each month from October to June, at 8:30 p. m., at the College of Physicians. Chairman, Dr. Fielding O. Lewis; Secretary, Dr. James A. Babbitt, 2117 Chestnut Street.

Abstracts from Current Literature

Ear

VALUE OF HEARING TESTS BY THE AUDIOMETER. J. IVIMEY DOWLING and R. L. WEGEL, Laryngoscope **35**:525, 1925.

The advantages of the audiometer over the usual tuning fork method in making the functional tests of hearing are set forth by Dowling and Wegel. It is well known that the time that tuning forks will vibrate depends not only on the forks themselves, but also on the force with which they are set in vibration. A fork in the hands of one observer may show fairly constant results, while when used by another the same fork may give a different result because of the force with which one sets the fork in vibration. Also, different forks used by the same observers will have different periods of vibration, while, in contrast, the audiometer gives a pure tone of standard intensity, and the minimum intensity necessary to excite the auditory nerve is determined rather than the length of time during which a tone is heard. It requires only a short tune to make the tests, and the error in observation is small. In many cases it is possible to make a complete test with this method in five minutes. The recorded graphs are easily interpreted and make possible a tentative diagnosis even before the making of a complete examination. They visualize to both the physician and the patient the defects in hearing and easily suggest whether the deafness is of middle ear or nerve origin. The graphs are analogous to visual charts and are of like value in picturing the hearing loss in percentage. The author also believes they are valuable in helping the patient to understand the existing condition by making a comparison of sequent charts. Since the audiometers are standard, an audiogram taken by one observer on his instrument will show the same curve as one taken on a different instrument by another observer. This is an important factor in patients who go to a different city for treatment or in the reporting of cases, as it gives a common ground for discussion, and a definite loss in percentage may be determined.

SOME REMARKS ON LABYRINTHINE SURGERY. EDWARD B. DENCH, Laryngoscope **35**:579, 1925.

Cases of labyrinthine invasion by a suppurative process are divided by the author into three classes. First, those in which the invasion of the labyrinth is so insidious that it produces slight or no symptoms. In this group belong those cases in which erosion, slight in degree, occurs in one of the semicircular canals, usually the horizontal. These cases present a history of a chronic middle ear suppuration, and the invasion is frequently so insidious and the progress so slow that no symptoms occur, but there is found at the time of a radical operation an eroded area in one of the semicircular canals.

The second class consists of the acute suppurative cases. In this class the invasion of the labyrinth occurs rapidly and is accompanied by well defined headache and vertigo. In the third group are those cases in which the invasion of the labyrinth is simply the first stage of an attack on the intracranial structures represented either by an infection of the meninges leading to diffuse meningitis or to an involvement of the brain substance itself, resulting in a cerebellar abscess.

As regards the treatment in the first type of case, the author is inclined to leave the labyrinth entirely alone. The usual radical mastoid operation is done, and if a fistula is present, the margins of the opening are gently curetted and all carious bone removed. The fistula should not be probed. In the second group, or those with an acute invasion of the labyrinth, it has been the author's practice to operate early on the labyrinth, doing a complete labyrinthine operation. The vestibule is entered through the horizontal semicircular canal, the canal being laid open widely and the cochlea drained by removing the ledge of bone between the oval and round windows. The lower and sometimes the middle turns of the cochlea may be removed by the cautious use of the curet, thus establishing thorough drainage. In doubtful cases in which the labyrinth gives no reaction to the caloric test the operator should always perform the radical operation, even in the presence of a comparatively acute history.

In the third class of cases in which the labyrinthine operation is employed as a primary measure for the surgical relief of meningitis, it is hoped by prompt operation to eliminate the primary focus of infection so early that the meningitis may remain localized. In these cases the author employs the Neumann operation with free exposure of the area triangularis as far as the internal auditory meatus, incises the dura in this region and drains the subdural space by means of a rubber tissue drain. The removal of the labyrinth in cases of meningitis has, in the author's hands, proved extremely unsatisfactory.

A Discussion of Some of the Clinical Problems of Chronic Suppurative Otitis Media. George E. Shambaugh, Laryngoscope **35**:593, 1925.

In a discussion of various clinical problems of suppurative middle ear disease, the author takes up first the relationship between chronic otorrhea and diseases of the nose and throat. That a relationship does exist he firmly believes, but he is fully satisfied that it is often exaggerated. Some of the important relationships are the extension of infection into the middle ear from the nose and throat, the development of tubotympanic conditions from growths in the nasopharynx, and that between latent infection in the nose and throat and such degenerative processes in the ear as chronic progressive deafness. The author is convinced that a great deal of misunderstanding exists regarding relationships between anatomic variations in the nose and defective hearing. Such relationships he believes to be mainly imaginary. It is claimed by many, for instance, that irregularities of the septum produce abnormal air currents in the nasopharynx which causes middle ear trouble, but Shambaugh's conviction is that no relationship whatever exists between such irregularities and otitis media.

As regards chronic suppuration of the middle ear, there are two types of cases: one in which there are elements of danger and the other in which elements of danger are practically absent. In the first there is a bone invading process, while in the other the disease is restricted to the mucous membranes lining the middle ear chambers. The problem, therefore, is one of differentiating between the simple and the bone invading process, for it is only in the latter that a radical operative intervention is called for, and in not all of these. The clinical differentiation is one which an experienced otologist can make with little difficulty, often after a single examination and certainly after a few weeks of observation. The amount of discharge plays an unimportant part, since the most dangerous forms of chronic otitis media are those in

which the patient is not aware that he has any discharge. Its character is of much importance. A mucoid discharge is rarely found in a bone invading process, it being, as a rule, purulent and containing granular sediment or cholesteatomatous material. The clinical significance of the odor is important. In bone invading disease, the odor is extremely offensive and shows no tendency to clear up on repeated cleansing of the ear. In the other type the odor usually disappears following some local treatment. Careful examination of the tympanic membrane gives important clues in distinguishing between the two types. The location of the perforation and not the size is the important point. One must determine whether the destruction is limited to the membrana tympani or whether it has also extended to and involved the bony margin. The latter always means a bone invading process. The marginal perforation seems to be essential, with few exceptions, for the development of a cholesteatoma, which is the most dangerous type of chronic otitis media.

In those cases of bilateral otitis media in which the radical mastoid is indicated on both sides, the author advises against operating both ears at once on account of the possibility of destruction of the hearing function. He feels that the proper procedure under such circumstances is to operate on the ear which is least useful in hearing and observe results. A principle to be kept in mind always in doing the radical mastoid operation is that the operation is being performed in order to eradicate a bone invading process which seriously threatens the patient's life, and not because there is a discharge. The operation is successful, in the author's opinion, if the focus has been eradicated, regardless of whether or not the discharge ceases. He believes a great deal of needless effort has been expended to close the eustachian tube.

In case of a diffuse labyrinthitis with a complete suppression of function, the author defines the indications for operation on the labyrinth in two ways. First, if there are evidences of a threatened intracranial complication, headache or change in the cerebrospinal fluid, it is important that the operation for the exenteration of the labyrinth be carried out immediately. In the absence of such complications, the question of draining the labyrinth hinges entirely on whether there exists independent of the labyrinth trouble indication for operation on the mastoid. When such an indication clearly exists then it is proper at the time of the operation also to drain the labyrinth.

SNAPP, Grand Rapids, Mich.

EXPERIMENTAL CLINICAL CONTRIBUTIONS TO THE SYMPTOMATOLOGY AND DEVELOPMENT OF OTOLITHDISEASES. T. GERMAN, Ztschr. f. Hals-, Nasen-u. Ohrenh. **11**:433 (Sept. 8) 1925.

B. S., a man, aged 39, suffered for years from a middle ear suppuration on the left side. The patient did not remember having been sick otherwise, except that he had pain in the neck for ten or twelve days when he was young. The present condition started three weeks before he entered the hospital. The patient could not lie on the left side and suffered from nausea and vomiting. Sept. 11, 1924, the patient could only lie on the right side. On turning to the left and when sitting up he became violently dizzy and nauseated. Then he vomited continually. In this position nystagmus of the third degree with large amplitudes could be observed. There was a facial paresis on the left side, no past pointing but pronounced adiadokokinesis and intention tremor. The dynamometer showed in the right hand 60, in the left hand 50. When the patient stood up, the following could be observed. The patient could scarcely

stand on his feet, he swayed to the right and left and almost fell down. With closed eyes, he fell immediately to the left and backward. The patient did not have any fever. The number of leukocytes was 13,000. The drum membrane was destroyed. The cochlear function was gone. When the position of the head was changed, the following was noticed. When the head was kept turned to the right, there was no nystagmus, either in the horizontal position or when the patient was lying on the right side. When the head was turned from this position to the left, no change occurred until the head passed only very little beyond the middle line. Then a rotary nystagmus of the third degree to the right set in immediately, accompanied by vertigo and vomiting. The farther the head was turned to the left, the more pronounced became the symptoms and the more unbearable became the subjective symptoms. When the patient was sitting up the same symptoms appeared but not with the same intensity. Nystagmus could not be noticed with certainty. The symptoms disappeared when the head was bent toward the right shoulder. When the patient was lying on the stomach he found the position of rest when the head was turned to the left. When in this position the head was turned to the right and the middle line was passed, the same symptoms appeared that could be observed when the patient was lying on his back and turned his head to the left. The nystagmus was constantly directed to the right. The caloric examination showed a typical reaction when the left ear was tested in the position of rest. When the examination was made with the head turned a little to the left from the middle line, the nystagmus increased. The calorized right ear showed a lively reaction. The condition of the patient forbade the examination in the turning chair. The ophthalmoscopic findings were negative. The cochlear function had returned September 14. A whispered voice could be heard in a distance of 10 cm. The facial paralysis had disappeared, but the other symptoms persisted. December 7, the patient could lie for a short time on the left side. The nystagmus was only of the first degree. Vertigo appeared only after from five to ten seconds with the same intensity as before, and with vomiting. The headache was still present and the partaking of food was unsatisfactory. December 16, the patient could lie on the left side without becoming dizzy, and without vomiting. The nystagmus was of the first degree. When the patient sat up there was no vertigo, but he perspired profusely. The headache was not so severe, and nourishment was taken better. December 23, the nystagmus had disappeared in the former position of vertigo. December 28, the patient could stand for from one to two seconds on his feet, but he could not walk. December 29, the patient could walk, but with great difficulty. With closed eyes he swayed but did not fall. There was no nystagmus. Jan. 6, 1925, the patient was discharged to the outpatient department. He did not complain of anything except a slight headache. His condition was continually excellent.

In the first stages of the disease, when the facial paralysis and symptoms of a loss of function of the acoustic nerve were present, the disease resembled an affection of the cerebellum or of the cerebellopontile angle region. After these symptoms had disappeared, the probability became less and less, although the atactic symptoms on the part of the upper extremities, with the exception of past pointing, continued for a long time; namely, the adiadokokinesis and the intention tremor. Yet the function of the eye was always normal. The exact examination showed, without a doubt, that a disease was present in which the attacks depended solely on the position of the head in space. They appeared only in certain positions of the head, independent of the relation of the head

to the trunk. The positions of vertigo were in the dorsal position and when sitting, when the head was turned to the left, and when it was bent to the left, respectively, or when the patient was lying on the left side entirely, or in the ventral position with the head to the opposite side, namely, to the right side. These attacks were accompanied by vertigo, nystagmus, nausea and vomiting. These symptoms did not cease in the vertigo position of the head. Single symptoms like vomiting were present also without the vertigo position and persisted after the attacks had stopped. Therefore, it was clear that a disease of the otoliths was present. German had reported a similar case previously, but this case differed from the former. In the former the attack occurred with the same intensity in all points of the position of vertigo. In this case a gradual increase was noticed the farther the head was removed from the position of rest. The increase in intensity in the position of vertigo is explained by an increase of the irritation of the otoliths which became stronger the further the head was removed from the position of rest. The explanation is satisfactory whether the pressure on the macula (Quix), or the hanging (Magnus and de Kleyn), is considered the maximal irritation. There was a destruction on the left side in consequence of a middle ear suppuration. This circumstance furnished an opportunity to solve the question whether this disease and those which show a similar complex of symptoms and which had been described as otolith disease really represented a change of the end apparatus of the nerve or whether they were caused centrally. This could be done by introducing drugs into the tympanic cavity. Nylen is of the opinion that the symptoms which stand in connection with the position of the head can be explained partly as peripheral and partly as central disturbances. In some of his cases considered by him to have been caused by central disturbances, central disturbances could be proved (encephalitis tumor, etc.). In these cases the peripheral or central origin of the symptoms of the otolith centers were part symptoms (focus symptoms) of a central disease. These cases are not considered here. German considers only cases of an isolated disease of the otoliths. Stein and Brunner are of the opinion that this complex of symptoms is rather caused by central factors. German is of the opinion that this view is wrong and thinks that he can prove his point of view by his tympanum experiments. The experiments with cocain, epinephrin and alypin gave the following results:

1. From three and a half to four minutes after a tampon with a 10 per cent. solution of cocain had been placed in the tympanum, the patient was able to turn his head to the left without becoming dizzy or without vomiting. Instead of a nystagmus of the third degree, a nystagmus of the first degree was noticed. In the position of vertigo the appearance of the attack was postponed for from twelve to twenty minutes. Once the trial was made to keep up the anesthesia longer, but the appearance of the attack could not be retarded longer. 2. In the second series epinephrin 1/5,000 was used. The result was the same as with cocain, but the attack was stopped considerably later, seven or eight minutes after the introduction of the tampon. This condition lasted for from fifteen to twenty minutes. 3. In order to avoid vasoconstriction a 10 per cent. alypin solution was used. With this solution the attack was detained only for eight or ten minutes. The vertigo remained absent, the nystagmus decreased to the first degree, but nausea was not always absent. The attack was stopped for from ten to sixteen minutes. 4. In order to exclude psychic factors a tampon with physiologic sodium chlorid solution was once placed in the tympanum. The attacks were not influenced thereby.

The before mentioned experiments were made between November 16 and December 2, at a time when the symptoms were stationary. The experiments established the fact that anesthetizing and vessel constricting remedies, or those which combined the two qualities, when introduced in the tympanum, prevented the attack. A direct influence on the end apparatus must be assumed. This could be explained by the connection between the tympanum and the labyrinth, perhaps by osmosis. Anesthetizing and vessel constricting substances had the same effect. Vessel constriction might have also an anesthetizing effect. The effect appeared later when vasoconstriction was used alone. A direct effect cannot be assumed because the time which was free of an attack did not coincide with the longer continued anesthesia. Alypin, which does not constrict the vessels, also stopped the attack, therefore, vasomotor factors did not play an exclusive part, even if we consider the labyrinthian vessels to be a shock absorbing system, according to Szasz. On the other hand, the intravenous application of epinephrin could not influence the attack in the least. Thielemann has shown that the application of epinephrin on the mucous membrane of tympanum did not influence the caloric labyrinth reaction. Precechtel explains the default of past pointing by the phenomenon of diaschisis, according to Monakow. This view is strengthened by the fact also that the anesthetizing of other mucous membranes, for instance of the conjunctiva, prevented the appearance of past pointing. The assumption of diaschisis which concerns the vestibularis end nuclei, and Deiter's nucleus, respectively, explains all results of Precechtel and makes it understandable that central cerebellar past pointing cannot be influenced by peripheral anesthesia. Diachisis, in the sense of Monakow, explains also the before mentioned experiments. The analogy with the experiments of Precechtel becomes clear if the change of position of the head is compared with the peripheral irritation of the skin, and if the attacks are compared with the past pointing. Just as Precechtel could notice the default of past pointing after anesthetizing the tympanum, the attacks did not appear in German's patient. The fact that the attacks could be stopped by means acting peripherally proves beyond a doubt that the change was brought about peripherally. Past pointing caused by central causes cannot be influenced by peripheral irritations. In an identical way it can scarcely be assumed that a complex of symptoms, of a central origin, could be influenced by the eighth nerve or any other nerve ending (trigeminus, etc.).

Conclusions: 1. There exist otolith diseases which do not show the same intensity at all points of the segments of the sphere. The intensity increases parallel to the degree in which the head is removed from the position of rest.

2. It is possible to impede the attack which accompanies the otolith disease by the introduction of anesthetizing and vessel-constricting means, respectively, into the tympanic cavity.

It would seem that clinical experiments prove that the complex of symptoms which is known as otolith disease is of a peripheral origin.

THE FORMS OF THE EUSTACHIAN TUBE. N. A. PANTOW, Ztschr. f. Hals-, Nasen-u. Ohrenh. **11**:466 (Sept. 8) 1925.

1. The eustachian tube is a ventilating apparatus for the middle ear.

2. It participates at the hearing accommodation.

3. It is the drainage tube for the secretion accumulated in the tympanic cavity.

4. By action of its ciliated epithelium, it pushes the secretion of the tympanic cavity outward and is a protective organ for the middle ear.

Each individual has a characteristic eustachian tube, but the many variations can be traced to a few types. Pantow injected the eustachian tubes with Hyrtl's mixture, 10 parts wax, 2 parts colophony and one part turpentine oil, according to a special method and with the necessary precautions, and procured good specimens from 55 cadavers. Of the fifty adults, twenty-six were brachycephalic, eighteen mesocephalic, six dolichocephalic, twenty showed chamæprosopy, twelve mesoprosopy, eighteen leptoprosopy.

$\frac{\text{Width of skull} \times 100}{\text{Length of skull}} = x$	When x = 70.0		dolichocephaly
	When x = 75.1—80		mesocephaly
	When x = 80		brachycephaly
$\frac{\text{Height of face} \times 100}{\text{Width of face}} = x$	When x. = 50.0		chamaeprosopy
	When x. = 50.1—54.0		mesoprosopy
	When x. = 54.0		leptoprosopy, dolichofacial condition

Specimens were also prepared from some animals (cat, calf, dog, sheep and pig).

The eustachian tube of new-born infants and children show all appearances of that of animals. It is rather straight, short and broad, the isthmus is missing, and its ending in the pharynx is not surrounded by a cartilagenous protuberance. All morphologic varieties were classified by Bezold as three types. 1. Twenty-four of the specimens showed the classic Bezold form of the eustachian tube with its screwlike turning and S-shaped bending. 2. In fifteen, the eustachian tubes were straight. 3. In eleven there was the S-shaped bending, and besides a bending of the cartilaginous part downward in the region of the isthmus. The cartilaginous protuberance is different in the different types. In Type 1, it approaches the condition in the child, the cartilaginous protuberance is little developed. Type 3 shows the highest prominence which may protrude up to 1 cm. into the nasal cavity in the shape of a funnel. The same condition can be observed at the isthmus. Type 1 has a wide, easily permeable isthmus, which is up to 4.5 mm. high and sometimes more than 1 mm. wide. The isthmus of the Type 3 is the narrowest, not over 3 mm. high. Its width is always less than 1 mm. 1. The skulls with the eustachian tube of Type 1 are in the majority of cases brachycephalic and chamæprosopic. 2. The majority of the chamæprosops has the eustachian tube of Type 1. 3. Contrary to this, there is no eustachian tube of Type 1 among the dolichocephalics and leptoprosops. 4. Almost all examined dolichocephalics had a eustachian tube of Type 3. 5. There is no eustachian tube of Type 3 among the chamæprosops. 6. Half of the examined leptoprosops had a eustachian tube of Type 3, and half of Type 2. 7. The eustachian tube of Type 2 is found in all classes. To this group belong the majority of mesoprosops. Summarizing, Pantow states that the eustachian tube (Type 1) shows the principle of the animal eustachian tube in a series of instances — in chamæprosopy — in other cases however, in dolichocephalics and leptoprosops, it differs the most from the original form (Type 3) by development of the bendings and the narrow isthmus. In a comparative anatomic, phylogenetic sense, the first type must be considered to be imperfect, the third type the perfect, and the second the transitory type. In old age, as Ioshii points out, the lumen of the cartilaginous porion is widened through atrophy of the fat at its lateral wall. Sometimes this widening does not take place uniformly in the whole tube. In this instance a diverticulum is formed at the lateral wall.

The outer forms of the eustachian tube can influence the pathology of the middle ear. A middle ear catarrh can more easily develop with the less permeable tube of Type 3. The easily permeable tube (of the child and Type 1) furnishes a more favorable possibility for the entrance of an infection from the nasopharyngeal space into the middle ear. The predisposition for suppurative otitis is greater. The observations of W. E. Perekalin confirm this point of view. In the majority of cases brachycephalics and chamæprosops with whom Type 1 prevails, suffer from chronic suppurative otitis media. The eustachian tube, however, furnishes only one of the paths of infection leading into the middle ear. The blood and the lymph current may be of greater practical importance, also the constitutional and hereditary factors. Formerly, a greater importance has been attributed to the eustachian tube in this respect. Ioschii considered a wide eustachian tube the only cause of the greater frequency of suppurative otitis in tubercular patients. Ioschii blamed the habitus phthisicus for the wide eustachian tube.

The influence of the eustachian tube on the results of the radical operation of the middle ear is of interest. The patency and easy permeability of the tube can prevent the epidermization of the cavity. Laurowitsch observed the postoperative course in seventy-eight patients on whom a radical operation had been performed. He found a complete healing of the cavity in 26 per cent. In all these patients the eustachian tube was not permeable. In about thirty patients under general anesthesia, Pantow examined the eustachian tube during the operation with soft probes. Without anesthesia the examination is too painful for the patient. The findings coincide with the findings on cadavers. In brachycephalics and chamæprosops, the eustachian tubes were more permeable. A probe with a diameter of 1.5 mm. could be passed. In leptoprosops the tube was less permeable. In some cases a probe of a diameter of less than 1 mm. could not be passed through the isthmus without force. The observation of the postoperative course showed that under the otherwise equal conditions (pathogenesis, constitution) in chamæprosops and brachycephalics the healing and epidermization of the cavity were retarded.

AMBERG, Detroit.

Nose

NASAL TAMPON TREATMENT OF SINUS DISEASES. J. IVIMEY DOWLING, Laryngoscope **35**:454, 1925.

A method of treating sinus disease by the use of nasal tampons is described by Dowling, who claims that such a method provides drainage and ventilation to the sinuses, improves the tone of the mucous membrane and subjacent erectile tissues, and makes possible the avoidance of a large percentage of the operative procedures within the nose or on the sinuses. This form of treatment is applicable to both acute and chronic conditions and, by its use, the author has frequently avoided the radical operation. In case an operation becomes necessary, much benefit is derived from the use of the tampons both preceding and following the surgical intervention, the underlying principle being the promotion of healthy tissue in the affected region. The technic described consists in winding some long fiber cotton about a long, thin wirelike applicator. This is then saturated with a 10 per cent. solution of protargin mild and placed well back in the nose above the scroll of the middle turbinate and between the turbinate and the septum. By a gentle twist the wire applicator is dislodged from the cotton and withdrawn. Tampons should be placed in both sides of the nose, regardless of the amount of infection, and left in place

for a considerable time, varying from ten minutes to an hour. The frequency of treatments is governed entirely by the length of time the induced effects persist, daily applications often being necessary, while in some cases once a week is sufficient. A single treatment, according to the author, will frequently bring about the cure of an acute head cold, while, on the other hand, some chronic conditions may require treatment over a period of months or even years.

SNAPP, Grand Rapids, Mich.

CONTRIBUTION TO THE THERAPY OF NASAL OCCLUSION BY SURGICAL LATERAL SUBLUXATION OF THE LOWER TURBINATE. S. BOURACK, Ztschr. f. Hals-, Nasen-u. Ohrenh. **11**:461 (Sept. 8) 1925.

Pugnat published his method of the improvement of nasal breathing by subluxation of the lower turbinates, May 31, 1919, in the *Revue Hebdomad.* This method is based on the same principle which had been promulgated long before that time by G. Killian, and which Bourack employed for more than fourteen years. Botey (1920) also recommended "el sportamiento del cornet inferior." Hennebert tried to obtain a free access to the nasal antrum wall by pushing the lower turbinate inward and upward. Through subluxation of the lower turbinate on the lateral nasal wall the physiology of nasal breathing is not interfered with. This subluxation can frequently be done easily with a strong raspatory. In some cases the lower turbinate must first be broken at its place of attachment. This can easily be done with a well fitting forceps. After this has been done it can easily be displaced outward. If the skeleton is harder, Bourack prefers his nasal speculum which he has used for endonasal ridge operations. It consists of two raspatories which are connected by a screw. With this instrument pressure can be exercised simultaneously on both lower turbinates. Pugnat uses a special forceps of which one branch is directed toward the septum and the other toward the lower turbinate. An injury to the septum is not excluded with Pugnat's forceps if the turbinate skeleton is rather resistent. It is necessary to use surface and infiltration anesthesia. In order to fixate the turbinate at its new place, a rolled gauze packing covered with Mikulicz ointment is introduced between the septum and the turbinates and left from forty-eight to seventy-two hours in place. Bourack did not see any complication in his 130 cases. In 10 per cent. of the cases there was a rather severe reaction during the first two to five days. All patients were treated in the outpatient department. The results were very favorable in 70 per cent. of the cases, moderately favorable in 20 per cent. and negative in 10 per cent. The lateral subluxation of the turbinate also proved to be useful in synechias of the nose. The synechias were separated and the lower turbinate was displaced outward. This method gives better results than the use of bougies, plates or tubes used for months. The submucous resection of the cartilagenous and of the osseous septum respectively in synechias, according to Eicken, has been used by Bourack with good results, but it is a more severe operation. Bourack has also used the subluxation of the lower turbinate inward and upward in many cases of radical operation on the antrum of Highmore, according to Denker, or of the modified Sturmann operation. Bourack used the dislocation of the lower turbinate also in his ozena operation. In rhinitis vasomotoria Bourack obtained good and lasting results by subluxation of the lower turbinate. Bourack emphasizes that good results may be obtained by small surgical interventions and that this should be taken into consideration when the urge toward "great surgical interferences" is in vogue, especially with the young surgeons.

CONCERNING THE ETIOLOGY OF GENUINE OZENA. A REPLY TO K. GREIF'S PUBLICATION, Abstr., Zentralbl. f. Hals-, Nasen-u. Ohrenh. **7**:3, 1925. BRUNO BUSSON, Ztschr. f. Hals-, Nasen-u. Ohrenh. **11**:464 (Sept. 8) 1925.

Greif contends that the assumption of an etiologic bacterial cause for the origin of ozena is not justified. Greif criticizes the ozena investigation, and adds some of his own investigations. He claims that he could show all the microbes which various authors have mentioned in the various secretions. Greif mentions that he found Perez-Hofer-stocks, which showed all transitory stages to liquefying stocks. Busson claims that this group never liquefies gelatin. Greif could never observe the appearance of suppurative catarrh of the nose (thick pus with many cells) in the animals used for experiments. Busson's experiences are different, although atrophy of the turbinate did not occur. Greif mentions that a paravenous injection explains the conchotrope and cartilage specific effect of the Perez and Shiga bacillus. Busson contradicts this statement and says that Greif dealt probably with too many proteus stock varieties and that this circumstance could explain his lack of success. Busson attributes the etiologic cause for certain forms of ozena to the coccobacilli of Perez-Hofer and Shiga, considering their pathogenity in animals, although he admits that in animal experimentation not the whole clinical picture of ozena can be reproduced. This applies to all other microbes which are pathogenic in man. Busson lays stress on the fact that the coccobacillus of Perez is never ubiquitous, and that it never has been found as a saprophyte in a healthy nose except in the dog. In some cases of clinical ozena the coccobacillus was found in pure culture. The group of Perez-Hofer microbes is a well defined unit. Microbes of the type of Abel, the proteus and pseudodiphtheria bacilli are ubiquitous and are found as saprophytes either transitory or permanent almost regularly on inflamed mucous membranes, or on those which have been changed by inflammation, especially those in the nasal and accessory nasal cavities. Yet this fact has not induced any investigator to believe that they would later become the cause of crust formation and of the characteristic ozena odor. Busson asks Greif where the coccobacillus of Perez has been found, if not exclusively in the secretion in ozena. Busson refutes the contentions of Greif which Greif directed against his findings and conclusions. Busson also refutes the stand taken by Greif concerning the etiologic significance of the saprophytes as an essential factor of the clinical picture of ozena.

AMBERG, Detroit.

Miscellaneous

A SIMPLE DACRYOCYSTORHINOSTOMY FOR THE CURE OF DACRYOCYSTITIS. FRANK M. HANGER, Laryngoscope **35**:475, 1925.

A simple operative procedure for the cure of dacryocystitis has been devised by Hanger, who believes that in order to effect a cure in this condition, normal drainage from the lacrimal sac into the nose must be reestablished. The principle underlying the author's operation is the conversion of the nasal duct into a gutter and was first devised by him in 1913, but more recently has been improved on in certain ways. A local anesthetic is usually used. The first step in the technic is the passage of a probe through the duct into the nose. This is followed by the removal of the anterior end of the inferior turbinate, care being taken to go back well behind the end of the probe. The probe is then withdrawn and some heavy silk thread is passed through by means of a probe-pointed cannula. The lower end of the thread is then passed through

the hole in the movable blade of the biting forceps and knotted, the hole being counter-sunk on the front face of the blade to receive the knot. Now, by pulling on the thread above, the point of the movable blade is brought tightly against the probe end of the cannula and the thread fastened in the two notches found at the top, to keep the point of the blade in this position. An assistant then draws the cannula slowly upward and the movable blade is caused to follow, thus making a gutter by cutting away the anterior and inner walls of the duct. At the same time the operator directs the movable blade upward, forward and inward. The posterior edge of the gutter is usually left with an irregular muco-osseous flap which may extend forward and eventually become adherent to the front edge and block up the gutter. This flap must always be cut away with triangular punch forceps. The nose is packed with a strip of gauze for twenty-four hours in order to prevent the possibility of any hemorrhage. A lacrimal probe should be passed and the sac irrigated daily until the natural drainage of tears is established, which usually takes about one week. Repeated observations with frequent applications of silver nitrate solution are often necessary over a considerable period, in order to insure perfect healing.

GASTRO-INTESTINAL DISTURBANCES IN INFANTS AS A RESULT OF OBSCURE INFECTION IN THE MASTOID. ARTHUR M. ALDEN and HARRY W. LYMAN, Laryngoscope **35**:586, 1925.

A close relationship between infections of the middle ear and gastro-intestinal disorders has been found by Alden and Lyman to exist in many cases. Such a relationship is frequently overlooked, however, or recognized too late to save the child's life. Renaud, in 1921, examined the middle ear and mastoid in seventy consecutive necropsies on infants that had died from athrepsia and infantile diarrhea. In all of them extensive suppuration in the middle ear and mastoid antrums was found. Thirty cases had been diagnosed as otitis media during life, while the remaining forty had been overlooked. The final diagnosis in practically all the cases was infantile diarrhea. In the authors' experience with a series of these conditions, they found that examination of the ears of these infants rarely shows the conventional signs of acute suppuration in either the middle ear or mastoid, and in none of their cases were any of the external signs of mastoiditis present. The drum membranes always show some change in color, the normal luster having given place to a dirty gray, opaque appearance. A distinct sagging of the posterior superior wall of the auditory canal is a frequent finding.

Ordinary incising of the drum membrane is often insufficient in these cases, due to the large amount of soft mesodermal tissue in the antrum, attic and upper portion of the middle ear which swells and prevents these cavities from draining out through the canal. Also, in order to insure good drainage, the incision must include not only the upper portion of the tympanic membrane but also the membranous floor of the mastoid antrum as well, for in infants the tympanic annulus in its superior portion is incomplete, thus causing a bulging downward of the antrum floor from any accumulation of fluid in that cavity. The authors advise an early operation on the mastoid rather than temporizing with more conservative measures, inasmuch as heretofore the mortality rate in this condition has been 100 per cent., while in their series, by early surgical intervention, they reduced the mortality 50 per cent.

SNAPP, Grand Rapids, Mich.

SENSORY APHASIA IN OTOGENOUS EXTRADURAL ABSCESS IN THE LEFT MIDDLE CRANIAL FOSSA. H. THORMANN, Ztschr. f. Hals-, Nasen-u. Ohrenh. **11**:429 (Sept. 8) 1925.

Sensory aphasia in the form of word amnesia is considered to be one of the most certain and most frequent symptoms of leftsided otogenous abscess of the temporal lobe, yet a small number of leftsided otogenous extradural abscesses has been known which were accompanied by sensory aphasia and which have shown crossed paresis. Moulonguet thinks that there are no symptoms which make it possible to establish a differential diagnosis between abscesses of the temporal lobe and extradural abscesses. The typical partial homolateral oculomotor paralysis, however (Koerner, Willebrand, Brandenburg), which does not occur in patients with extradural abscesses, has made certain the diagnosis of a temporal lobe abscess in some cases as the only local symptoms (Henke). Thormann describes a case in point. His patient, a man, aged 21, exhibited as the main symptom sensory aphasia. The operation revealed an otogenous extradural abscess in the left middle cranial fossa. A brain abscess could be excluded by several unsuccessful aspirations of the brain and by normal liquor findings. The favorable outcome corroborated the assumption. It is reasonable to consider the effect of pressure to be the cause of aphasia (G. Alexander). In small abscesses, however, effects of pressure cannot be the cause (Salzer, Pritchard, Merkens). Merkens is of the opinion that the brain symptoms are caused by a spontaneously recovering serotoxic and not bacterial meningo-encephalitis which is collateral to the infectious focus (Takabatake). Lorenz observed in a case of extradural abscess, with sensory aphasia, that, on repeated examinations, the same objects were also named wrongly although with different names. Thormann did not observe this in his case, but remarks that further examinations in similar cases may show differences between the sensory aphasia in extradural abscess and in abscess of the temporal lobe.

CONCERNING THE FREE TRANSPLANTATION OF BONE, CARTILAGE, AND FAT IN OTORHINOLARYNGOLOGY (FROM A BIOLOGIC AND CLINICAL STANDPOINT). S. BOURACK, Ztschr. f. Hals-, Nasen-u. Ohrenh. **11**:441 (Sept. 8) 1925.

Bourack comes to the following conclusions:

1. Free transplantation of bone, cartilage and fat is of great practical value in otorhinolaryngology (in nasal deformities, defects of the larynx and the trachea, etc.). It also has a great theoretic interest, because this question is closely connected with various biologic problems (regeneration, function, immunity, constitution, etc.).

2. The comprehensive experimental and clinical literature concerning free osteoplastic procedures has not yet cleared up many important points (for instance, the main sources of regeneration, the part played by the periosteum, by the bone marrow, by the endosteum and the mother soil, or concerning the importance of the original place of the plastic material, living or dead, autohomeoplastic or heteroplastic, or concerning the end-results, etc.).

3. Some theoretical views on which some of our practical methods are based, as, for instance, in rhinoplastic work, must undergo a critical revision from a biologic standpoint. This applies, for instance, to the point of view of the doctrine of physicochemical affinity or contrary action of the tissues, their ability to survive, their possibility to be preserved in vitro, etc.

4. The transplanted bone will mostly not participate in the healing process as such, but lasting results in a free osteoplastic procedure can be obtained only as consequence of secondary processes of regeneration which go hand in hand with processes of resorption.

5. The preponderating part played in bone transplantation of the bone forming elements has not yet been established, also not that played by the periosteum and by the bone marrow with endosteum. In the clinic their positive part seems to have been proved especially in transplantations into the soft parts.

6. The result of free osteoplastic procedure varies not only from author to author, but also with the same author. The end-results depend on various technical, local and general factors. There are certainly also some biologic causative factors which still need investigation.

7. The autoplastic transplantation in osteoplastic surgery furnishes better prospects, also in the bone layer. The processes of resorption preponderate in homeoplastic and heteroplastic operations, and in plastic with the aid of dead material. The newest investigations and experiments to correlate the outcome of the transplanted material with the hemologic-biologic reactions (isoagglutinins, organospecific substances, elements of the blood which favor regeneration after lesions, etc.), show the right way which must explain many obscure points of plastic procedure.

8. Critical revision of the literature, the author's own observations and theoretic considerations (as seen from the point of view of the physiologic function of the tibia, the importance of pressure on the transplant, etc.), seem to justify the author's skepticism concerning the classic method of rhinoplasty (according to Israel). In simple saddlenoses it is preferable to resort to prostheses of paraffin and petrolatum or fat autotransplantation, or bone splinters from the nasal skeleton or its surroundings, for instance, from the nasal ridge or from the border of the pyriform aperture.

The views of different authors vary concerning the value of free transplantation of cartilage. Parts of the auricle usually do not heal in the borders of defects of the alae nasi, according to the experiences of others and of the author. The use of cartilage in saddlenoses cannot be recommended, according to the experiences of the author, nor from a theoretic point of view.

10. A permanent cure and a permanent result in free chondroplasty can only be considered when the time of observation is rather long, on account of the torpid reaction of cartilage to various inflammatory, traumatic, infectious and other irritations, and on account of the little pronounced power of regeneration of cartilage.

11. The tendency of some modern, especially American, authors to use cartilage of the rib or of the nasal septum instead of bone, in saddlenoses, is based on little substantiated theoretic premises.

12. Fat transplantation deserves greater application in surgery and otorhinolaryngology on account of its physical and biologic qualities. The exaggerated skepticism of many surgeons and otorhinolaryngologists does not appear to be justified.

13. The end-results of free fat plastic operations depend on the method and technic, aside from various local and general factors.

14. The author's personal experiences speak in favor of fat plastic surgery. Aside from ordinary indications, its use is commendable in persistent parotitis fistulas, for instance after typhus exanthematicus and in a protracted torpid course of healing after antrotomies.

AMBERG, Detroit.

Society Transactions

COLLEGE OF PHYSICIANS OF PHILADELPHIA, SECTION ON OTOLOGY AND LARYNGOLOGY

Oct. 21, 1925

FIELDING O. LEWIS, M.D., *Chairman*

A CASE OF SUBLINGUAL CELLULITIS FOLLOWING TONSILLECTOMY. Presented by DR. GEORGE FETTEROLF.

Three days following tonsil removal under general anesthesia, the patient, a woman of middle age, began to complain of pain in the right side of the throat. Two days later moderate swelling of the neck, floor of the mouth and tongue and edema of the epiglottis was present. The leukocyte count was elevated to 10,100; the temperature to about two degrees above normal. For several days this swelling increased. A tracheotomy was averted by spontaneous resolution of the cellulitis following external heat applications and the use of alkaloidal sedatives. It was the feeling of Dr. Fetterolf that the most plausible explanation of the condition was thrombosis of the lingual vein with concomitant stasis in the venae comites of the lingual artery, sublingual and superior laryngeal veins.

A CASE OF TONSILLAR VERTIGO AND ASTHMA. Presented by DR. W. A. HITSCHLER.

A man, aged 63, was treated by Dr. Hitschler for the relief of vertigo and asthma. A rather pronounced otorrhea which had been present since childhood yielded to local treatment, but no improvement in the cardinal symptoms of vertigo and asthma occurred. Attention was then centered on the tonsils which contained some cheesy detritus. Local treatment in this region, consisting of lavage, tincture of iodine and silver nitrate applications, gave the patient marked relief from both vertigo and asthma. He refused to submit to tonsillectomy but compromised by allowing partial removal under local anesthesia. This was performed in a number of sittings. At the present time, although a small amount of tonsil tissue still remains, vertigo and asthma are almost entirely absent.

A CASE OF INTRANASAL OSTEOMA. Presented by DR. AUSTIN P. SMITH (by invitation).

A man, aged 28, was admitted to the Jefferson Hospital complaining of right-sided nasal obstruction, first noted three months previous to examination, which became progressively worse. Examination showed complete occlusion of the right side of the nose by a reddish granular mass. Underneath this covering a smooth gray surface presented which had the consistency of stone. Roentgen-ray examination gave evidence of a large bony ovoid mass occupying the entire right nostril extending into the post-nasal space on that side. The antral wall was pushed out and the palate downward. Studies for the detection of systemic disease were negative. Dr. Fielding O. Lewis removed the growth

by incision beneath the upper lip, as it was impossible to disintegrate the mass. The tumor weighed 65 gm. and measured 6 by 4.5 by 3 cm. No definite point of attachment could be observed. Histologic examination showed the mass to be made up of both compact and cancellous bone.

DISCUSSION

DR. LEWIS stated that when he first saw the patient, he was reminded of a rhinolith removed by him several years before, which was removed by disintegration. In the case mentioned here, however, the mass could not be fragmented.

ACUTE AND CHRONIC MASTOIDITIS WITH ATYPICAL LATERAL SINUS THROMBOSIS. Presented by DR. J. CLARENCE KEELER.

DR. KEELER made a plea for the early operation of mastoid conditions, and emphasized the dangers which attend the awaiting of classical symptoms. To emphasize and illustrate his point he presented 4 patients on which he had performed mastoid operations.

Case 1.—A man, aged 43, had been suffering from an acute suppurative otitis media for nine weeks. The temperature elevation, associated with a chill, brought about his admission to the Jefferson Hospital. Mastoid operation showed a large perisinus abscess, together with thrombosis of the lateral sinus. In the absence of pronounced clinical symptoms and negative blood culture the sinus was not disturbed. The patient improved and was discharged. At the time of writing, however, pressure over the mastoid causes pus to appear from the stump of the lateral sinus. Further operation is indicated, but the patient feels so well that he will not submit to operative interference.

Case 2.—A girl, aged 17 years, had suffered from chronic purulent otitis media since childhood. When seen by Dr. Keeler she was experiencing an acute exacerbation of her ear condition. Pain over the top of the head was constant. Pressure over the mastoid aggravated this symptom. Cerebration was impaired. Neither chills nor fever had occurred. A radical mastoid operation showed cholesteatoma under pressure throughout the entire mastoid bone. The dura was exposed, the lateral sinus collapsed and disintegrated, and a perisinus abscess was present. The cerebellum was decompressed but the sinus was not disturbed. Uneventful recovery followed.

Case 3.—A man had suffered from chronic aural discharge since boyhood. When he was admitted he was suffering from cerebral vomiting, headache, rigors, sweats, and temperature elevation. A radical operation showed the mastoid cavity to be filled with cholesteatoma. The lateral sinus had been destroyed. The base of the petrous bone was disintegrated and the cerebellum was exposed. A connection with the middle fossa was present where the tegmen antri had been eroded. The facial nerve passed through a mass of cholesteatoma, but retained its function. The operation was followed by uneventful recovery.

Case 4.—In this case symptoms of right sided cerebellar involvement were present. This patient, a man, had a chronic suppurative ear condition since childhood. Before operation he complained of occipital pain, vomiting, numbness of the right side of the tongue, right arm and leg, defective speech, and difficult locomotion. The right labyrinth was dead. A radical mastoid operation exposed a mastoid cavity filled with cholesteatoma, the facial nerve exposed,

and the labyrinth a sequestrum. The lateral sinus was obliterated and a large cerebellar abscess evacuated. The patient recovered with almost complete restoration of the functions previously disturbed.

DISCUSSION

Dr. E. B. Gleason was surprised to learn that such extensive involvement gave rise to so little constitutional reaction in these cases. He also considered them to be instructive from the fact that in no case was the jugular vein ligated.

Operation on the Sigmoid Sinus. Presented by Dr. Curtis C. Eves.

Dr. Eves spoke about the technic and indications for operation on the sigmoid sinus. In addition to operative technic, the following points were emphasized:

1. Free incision of the sinus wall when knowledge of its contents is desired.

2. Delay of ligation of the internal jugular vein when evidence of blood stream infection is absent.

3. Symptoms and operative findings should determine the extent of jugular surgery.

DISCUSSION

Dr. B. A. Randall emphasized the difference between acute and chronic sinus cases, in which the requirements and outcome are very different. The acute cases show a strong tendency to spontaneous closure by a clot that does not call for intervention. In chronic disease of the sinus, the same tendency is absent and operation along with jugular ligation is essential.

Agranulocytic Angina: Report of a Case with Fracture of the Tibia. Presented by Dr. Robert J. Hunter.

In the last three years, twenty cases of agranulocytosis have been reported. Although this condition has been given various names, such as agranulocytic angina, malignant leukopenia with low neutrophil count, etc., all have the same peculiar blood picture combined with lesions of the throat. The erythrocytes, hemoglobin, and platelets are normal or slightly lowered. The leukocytes are greatly reduced, sometimes being as low as 600 cells per cubic millimeter. This reduction occurs almost entirely in the granular leukocytic series.

The onset is similar to any severe acute infection. Only women between the ages of 22 and 65 have been observed with this condition. Inflammation and ulceration of the throat, tonsils, tongue and larynx is fairly constant. Similar inflammatory reactions have been noted in other parts of the body.

The case reported was that of a woman, aged 45, who had been admitted to the hospital on account of fracture of the left tibia. On admission, the blood picture was approximately normal. For two weeks she followed the course of the usual fracture case. At this point she developed fever and body pains. The temperature was 102 F., and a typical erythema multiforme developed. A few days later sore throat was complained of; inflammation and erosion of the soft palate, uvula and anterior faucial pillars were noted. A blood count at this time showed a marked leucopenia with total absence of polymorphonuclear leukocytes. A pulmonary condition resembling bronchopneumonia developed. Death occurred in about ten days. Permission for necropsy was refused.

Dr. Hunter suggested that in all cases of obscure throat ulceration complete blood studies should be carried out.

DISCUSSION

DR. EDWARD KRUMBHAAR (by invitation) said that this striking and clear cut clinical picture was described only three years ago by Schultze at a meeting of the Berlin Medical Society. The short account, which occupies less than a half column in the *Deutsche medizinische Wochenschrift* (**48**:1495, 1922), covers, however, practically all the important points that have since been described. Dr. Hunter's case seems to be a fairly typical example. Dr. Krumbhaar considered the fracture to be a coincidence with the possibility of offering a site of entrance for the peculiarly virulent infection.

One of the still unsettled questions is whether the sepsis or the change in the blood picture is primary. A careful study of the cases hitherto reported make it clear that in some patients evidence of sepsis existed before the blood change was apparent, so that it seems much more likely that the sepsis is primary and the deficiency in the granulocytes (polymorphonuclears) results from the peculiar infection, just as it does in mustard gas, benzol poisoning and virulent influenza. Like these diseases, also, the fatal termination is due to pneumonia, presumably so virulent because the leukocytic defense has been largely abolished.

In regard to the name, Dr. Krumbhaar suggested that as the inflammation and ulceration are by no means confined to the throat, but have been found throughout the digestive tract and even in the vagina, "Agranulocytic Angina" is less preferable than the more general term "Agranulocytosis," or possibly accompanied by some limiting adjective, such as "Septic Agranulocytosis."

Just as in all blood conditions it is profitable to consider whether the lack of formed elements is due to decreased formation or excessive destruction or both, so in the present instance it is clear from an examination of the smears that there is an almost total lack of formation of the polymorphonuclears. This is also confirmed by bone marrow studies of the fatal cases. It is quite remarkable, however, that inhibition activity of bone marrow activity should be so strictly limited to one type of cell. In most other bone marrow dyscrasias, such as pernicious anemia and purpura hemorrhagica, although one element may be diminished more than others, usually the others suffer as well to a lesser extent.

As these cases of Agranulocytosis are presumably going to be recognized more often in the near future, and perhaps most frequently by the nose and throat men, Dr. Krumbhaar thought that Dr. Hunter had done very well in bringing the condition to the attention of the Section on Otology and Laryngology.

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